N.A.A.S.

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ABSTRACTORS

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QUARTERLY REVIEW

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No. 6 Winter, 1949

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ARTICLES

EXPERIMENTAL HUSBANDRY FARMS: 2. BOXWORTH

E. T. Sykes

Farm Director

Boxworth, nine miles from Cambridge and midway between Cambridge and Huntingdon, lies on the north side of the clay plateau which runs west and south-west from Cambridge into the neighbouring counties of Bedford and Huntingdon. The soil is derived from Boulder clay, and the farm has been selected as the husbandry farm for the clay lands in a dry area. There is an extensive area of Boulder clay soils in East Anglia, and the climate at Boxworth is fairly typical of that of the Eastern Province. Records at the meteorological stations nearest to the farm show an average annual rainfall of 23-24 inches ; as in most of East Anglia, July is one of the wettest months of the year because of the thunderstorms experienced in that month. Hours of sunshine average about 1,500 annually.

Lay-out and Buildings

The husbandry farm comprises three farms (totalling 830 acres) which have been hired on a long lease from Michaelmas, 1948. The three farms have been farmed in one block for a great many years, under the local name of Cuckoo Pastures Farm. The farm is rectangular in shape, with a County Council road (but no through-way) bisecting it longitudinally. The main set of buildings, known as Cuckoo Pastures, is in one corner of the farm, and comprises farmhouse, two barns, two small implement sheds and three useful open stock-yards, each with a covered lodge. There is also a Turner vertical grain drier with a capacity of up to 4 tons per hour, installed in 1944. There is, however, no equipment for the bulk handling or bulk storage of grain, and consequently drying for local farmers has to be restricted. (See Plate 2.)

Off the road bisecting the farm are two sets of buildings, High Barns and Extra Farms, the latter some $1\frac{1}{2}$ miles from Cuckoo Pastures. At High Barns there is a pair of cottages and a small barn with an open yard, which is almost derelict (see Plates 3 and 4). There is a pair of cottages also at Extra Farm, with a good set of buildings comprising two open yards, seven loose boxes, a barn, and small cart-shed (see Plate 5). These buildings were practically rebuilt in 1945 and are in good condition. Apart from this, only essential maintenance has been done to the farm buildings generally during the past ten years, and attention will have to be given particularly to roofs and to the weatherboarded walls of most of them. The cottages are in no better repair and the only amenity is mains water at a standpipe outside each pair.

The only other building on the farm is Samsons Barn, a small wooden barn with thatched roof that is now derelict. There used to be a cattle-yard with the barn, but, being away from a hard road, it fell into disuse many years ago.

Before the extension of R.D.C. water mains, the only source of water was from ponds, of which there are eight on the farm. These are supplied by surface drainage and from drains running to them, and consequently are an uncertain supply during drought. There is no stream running through the farm. R.D.C. mains now run along the public roads to the north and west of the farm, and mains water is connected to all three sets of buildings and to about 100 acres of land adjacent to Cuckoo Pastures and Extra Farms. Further connections to the mains will not be difficult and will enable most of the farm to be watered when required.

A feature of the farm is the diversity in the size of the fields. Examination of old maps shows that there has not been a great deal of amalgamation of fields, and the present total of forty fields is not much different to what it was in the past. Field size varies from 4 acres to 99 acres (the latter at one time was six fields) ; fourteen fields are more than 20 acres each. Almost all the fields are bounded by thorn hedges (none of which is stockproof), with ditches to carry away drainage water. (See Plates 1 and 6.)

The relatively large size of the fields is typical of the clay plateau of west Cambridgeshire and may be a result of the undulating nature of the area. The centre of the farm is the highest point, approximately 220 feet above sea level. Most of the land lies between the 150-foot and 200-foot contours with only very gentle slopes to the fields. The fields on the west side, however, slope down to the 100-foot contour rather more steeply than is desirable for crop experimentation.

Lastly, reference must be made to the woods, spinneys and belts on, and adjacent to, the farm. These consist almost entirely of elm, ash and a few hazel, with an occasional oak, and provide sanctuary for rooks and rabbits. Overhall Grove, a wood of some 40 acres, forms part of the west boundary and has had to be wired in against rabbits.

Soil Type

A detailed survey of the farm has not yet been made by the Soil Survey of Great Britain, so it is possible to give only a general account of the soil types. The majority of the farm is Boulder clay containing small flints and chalk fragments. At the back of Cuckoo Pastures lie a few acres of Kimmeridge clay, while in the north-west corner there is an area of some 50-60 acres of Ampthill clay lying at the base of the slope to the west. Chalk fragments appear to be more abundant in the Boulder clay than in the area of Kimmeridge and Ampthill clays, and on three fields chalk marl appears in patches on the surface, but this occurrence is not typical of the farm as a whole. Agriculturally, all three clays are difficult to work, have impermeable subsoils and are naturally deficient in phosphate.

Cultivation and weathering has formed a brown coloured topsoil, but the soils would be regarded by the farmer as clay rather than heavy loam and would be classed as " three-horse land ". The impermeable subsoil makes cultivation almost impossible without mole or tile drainage or a combination of both. Drains are still being found to a depth of 5 feet in some fields, and many of them continue to function as soon as the outlet is cleaned. The farm has the advantage of gentle natural falls to most fields, which enable drainage to be secured without undue difficulty.

Previous History

The history of the farm has been one of arable farming, though the efficiency of the farming has varied with the tenant and with prices for farm produce. There does not seem to have been the tendency to lay down large areas of the farm to grass in bad times, possibly because the farm has not been highly rented. To maintain the farm as arable, however, continual maintenance to drainage and ditches would have been necessary, and in bad times this seems to have been neglected. Under good husbandry the farm grew good crops of wheat, beans and oats ; while yields of barley were good in most seasons, the quality was seldom very high since it is usually impossible to drill spring corn in good time. When properly managed, the clay grows good grass, though the grazing season is necessarily restricted and winter grazing is out of the question because of poaching.

As with much of the clay lands of East Anglia, the history of the farm is concerned with the sale of wheat, beef, mutton and, perhaps, pork and bacon. Dairying has not been attempted at Boxworth, no doubt because none of the buildings is suitable. During the 1920s and 1930s the farm deteriorated, although still mainly arable and with only some 120 acres of grass ; the land was neglected and apparently no work was done to the drains, ditches or hedges. As a result the land became foul and over-run with rabbits. In July, 1940, the farm was requisitioned by the Cambridgeshire W.A.E.C., and the record of condition then made shows that crops were very poor, full of rubbish and, in many cases, not worth harvesting ; ditches were blocked and hedges growing several yards into the fields ; there appeared to be no sign of any rotation having been in force. The W.A.E.C. reclaimed the farm and farmed it until Michaelmas, 1948. All the ditches were dug out, hedges were cut to ground level and about 300 acres mole-drained or tile-drained.

During the past nine years the farm has been heavily cropped with cereals. The acreage of long leys has varied from 30 acres to a maximum of 140 acres, and the proportion of arable has thus been very high. For the most part the arable has been cropped on a rotation of three years' cereals followed by a one-year recuperative crop, e.g., red clover, beans, peas, potatoes, roots and (very occasionally) a bare fallow. As a result the cereal acreage has been as high as 600 acres in some years, and never less than 500. About 300 acres of wheat were grown annually and the balance equally divided between oats and barley. Home-

reared stores and purchased stores have been run on the grass in the summer and in the yards during the winter, but the limited amount of yard room has meant that not much more than 40 acres have received farmyard manure in any year. Reliance has, of course, been placed on fertilizers, principally phosphate and nitrogen. Potash does not seem to have been needed for cereals, and average dressings are sufficient for other crops.

Present Condition

The concentration on cereals which has been necessary during the past nine years is reflected in the present condition of the farm. Take-all is not widespread, despite the large annual wheat acreage, and many fields this year showed little or no infection. On the other hand, two or three fields showed an alarmingly high proportion of infected plants. Weeds, particularly annual weeds, are a much more serious problem. The farm is almost completely free from twitch (*Agropyrum repens*), but most of the fields are more or less heavily infested with wild oats (*Avena fatua*), slender foxtail or black grass (*Alopecurus agrestis*) and charlock. The first two are the more serious, and " black grass " fallows will have to be included in the rotation for some years. Charlock has been prevented from seeding latterly by the use of a plant-growth regulator type of weed-killer, and there is no reason why this weed should continue to be a serious one.

There has always been some wild onion (*Allium vineale*) on the farm, but infestation is not increasing and few were found this year. Cleavers or goose-grass (*Galium aparine*) is troublesome on some fields in autumn-sown corn, but a good kill was obtained this year by spraying with DNOC in May. The infestation probably originated in the coppice belts where the weed grows profusely. During the late summer and autumn field bindweed (*Convolvulus arvensis*) appears in great quantities, even on fallows, and may well prove to be the most difficult weed to eradicate. It is anticipated that the expansion of long leys from the present acreage of 90 to 300 during the next two years will help to clean the farm. Apart, however, from weed control, this expansion of leys with the corresponding increase in head of livestock (including a Friesian herd) will help to restore humus and make for easier working of what is now a rather intractable soil.

Correction

Inbreeding in Poultry (No. 5, p. 6, para. 4, line 4), for "*sub*" read "*sib*".

RESEARCH ON VEGETABLES

J. PHILP

Director, National Vegetable Research Station, Wellesbourne, Warwickshire

It is fairly common knowledge that a new Vegetable Research Station is being set up and, in consequence, there is keen interest in the type of research it is intended to carry out. The objects of this research can be stated very simply: to help the vegetable producer, both professional and amateur, and indirectly to help the consumer. This can be done in three main ways: (1) by increasing crop yield per acre, (2) by improving crop quality, and (3) by reducing the cost of production; at the same time the soil fertility must be maintained and, if possible, improved. The benefits of improved quality and reduced costs of production are clear, but the advantages of stepping up the yield per acre may be disputed. It must be admitted, however, that if the yield per acre can be increased without unduly increasing the cost, a smaller acreage will meet the demand for the product, thereby increasing the acreage available for other necessary crops—a vital factor in our present economy. In fact, much of the stepping up of yield per acre consists in reducing losses in yield, i.e., getting nearer to the yield that is always hoped for but seldom achieved. The work of the research station, therefore, will be directed broadly along these three main lines.

Breeding

Plant-breeding is one of the most promising ways of achieving these objectives. Seedsmen and growers who have produced the fine varieties we have today are to be congratulated on their work, but nevertheless, it should be possible to breed still finer varieties. Seedsmen will readily admit that for purely business reasons certain breeding programmes cannot be tackled by the trade. This is one of the strongest arguments for establishing a Vegetable Research Station, for by carrying out such programmes (not necessarily confined to breeding) it will be providing a national service.

At the outset it is probable that variety-testing will be merged with plant-breeding. Thus, we shall begin by growing as complete a collection of varieties as possible, obtained both from this country and from abroad, in order to test, compare, and study them in detail. In this way it will be possible to recognize synonyms and superior varieties and to ascertain which varieties, though good, could be much improved by selection and purification; this work would be taken up. Such material will also be valuable for the purpose of hydridizing and selecting in an attempt to produce improved varieties. Ancestral forms of our present day vegetables will be collected, grown and studied, because it is possible that some of them may have desirable characteristics which are not found in modern varieties and which may be capable of being transferred to them by the appropriate breeding methods.

The following are some of the characteristics or properties which may be improved by the above methods:

Yield;
Quality (appearance, taste, and food value);
Resistance to pests and diseases;
Suitability for special soil and/or climatic conditions;
Suitability for special cultural methods, e.g., frames, cloches, or mechanized treatment;
Definite and different times of maturation, thus helping to avoid gluts and to prolong the season;
Ability to withstand handling, transport, and storage;
Suitability for special purposes, e.g., fresh market, canning, dehydration, freezing.

This list will serve to indicate the range of possibilities that exist for improvement by breeding. It ought, however, to be pointed out that there are some characters where improvement in any one of them may have a beneficial effect simultaneously on yield, quality and cost of production, e.g., resistance to a disease. Study of the list will bring to notice another important point. It will be seen that in carrying out this work the breeder will require the co-operation of other specialists—the biochemist, the soil chemist, the physiologist, the pathologist, the entomologist, and the statistician. This illustrates how the solution of biological problems invariably requires the team-work of a group of specialists in different subjects. It is intended that a complete team of specialists will be formed at the Vegetable Research Station and that they will be provided with facilities and equipment so that each problem will be tackled from all the essential angles.

In consequence of the above breeding work, it will be essential to carry out a certain amount of seed multiplication. Seed will be required for testing new varieties, and, when the latter have proved themselves, stock seed will be needed for distribution. Supplies of seed will also be required to provide genetically controlled material for other research purposes. Conditions in Essex are well known to be highly suitable for seed production of vegetables and, indeed, this is an important industry in that area. A sub-station is therefore being established in Essex mainly for the purpose of seed multiplication, and it is hoped that research in this subject will provide results of value to the industry there and elsewhere.

Crop Culture

Much empirical knowledge of the culture of vegetables has been acquired through the long experience of growers, and there is no doubt that a great deal of this knowledge is sound. It follows, therefore, that there are many rule-of-thumb methods which are generally accepted. Some of these old and long established methods, however, should be tested and studied in detail. In this way an understanding as to why they are satisfactory will be obtained, and it may then be possible to modify and improve them. On the other hand, it may be found that some of the old-fashioned and customary methods are not

the best. Thus, for example, it may be that a good method for one area has spread (because it is good) to another area where the conditions are different and where, in consequence, the method is not entirely suitable or may even be unnecessary. It may also be that a method may have been sound in the past, but is no longer sound owing to changed conditions, e.g., new varieties with new characteristics and requirements, scarcity of labour and its high cost, the availability of mechanical power, new materials such as synthetic fertilizers and weed-killers, and the shortage of fertilizing materials used in the past, such as dung. In fact, much of the work of the research station will consist in bringing vegetable culture up to date, i.e., adapting it to present-day conditions and needs, and making full use of modern inventions and scientific knowledge.

Broadly speaking, therefore, studies will be be made of methods of cultivation and their effects on the crop, on the soil, on weeds and on costs. Weed control will be investigated, both culturally and chemically, especially with crops which are slow to germinate, e.g., carrots and parsnips, and with crops that are difficult to clean, e.g., asparagus and onions. Within the category of methods of cultivation will come a variety of factors, such as optimum spacing of plants ; rates, dates and depths of sowing ; methods and dates of transplanting ; rotation of crops ; and so forth.

Manures and Soils. Here is an example of how one factor has an effect on and is affected by other factors. This type of problem involves the simultaneous study of these several factors and their interaction on one another ; hence the need for a team of research workers at one main station. It also shows how difficult it is to describe the work of such a station under subject headings which must be arbitrary. Each subject is closely interconnected with others, and it is impossible to define the boundaries. Manures have an effect on the crops and the soils, the soils have an effect on the manures and the crops, and the crops have an effect on the soils.

In order to overcome the disadvantage of inadequate supplies of dung, it is clear that we must investigate green manuring, the use of compost and sewage sludge, and the adoption of leys. Also we want to get definite evidence as to whether it is really necessary or profitable to use expensive organic manures, like bone, horn, hoof, blood, meat and bone meal. These must be compared accurately with the new synthetic organic manure (still in the experimental stage) and with inorganic fertilizers in their effects on the crop, on the soil, and on costs. We must determine also what kinds of manure and what dosages are most effective, and how and when application should be made to give the best results with different crops, different soils, and different climates. Much more information is needed on the effects of manurial treatment on crop yield ; time of maturation ; crop quality (e.g., appearance, taste, cooking quality and nutritional value) ; hardiness ; the ability of the crop to withstand handling, transport, storage, and marketing ; the processing qualities of the crop ; and on the soil itself.

All this involves long-term experiments with vegetables grown under different treatments. Over a period of many years the station will be measuring the effects of the treatments on the yield and quality of the crops, the properties of the soil (biological, chemical and physical) and weed population. These experiments should provide valuable information, and no doubt much of it will be of an unexpected nature. They should give us a lead on the main objective—obtaining maximum production and quality from the soil while maintaining fertility.

Irrigation. Irrigation is a subject that is relatively new to vegetable-growers in this country, and it is certain that much remains to be discovered. Many factors require investigation, such as time, date and rate of application, quantity and temperature of the water applied, and the introduction of substances (e.g., nutrients) to the irrigation water ; also the effects on the crop and on the soil must be measured.

Pests and Diseases. Despite the rapid progress made in recent years in the control of pests and diseases of crop plants there is need for further research. Growers are probably more aware of this need than they are for that research concerned with other forms of crop improvement. This is to be expected, since the damage and loss can be seen and measured, whereas potential improvements in other directions are abstract—and hence less impressive—until demonstrated experimentally. It will be appreciated that in the experimental work in various directions which has been outlined above, the effects on the incidence and control of pests and diseases will be studied ; in consequence new knowledge will be forthcoming and treatments, to be successful, will require to pass this test as well as others. In addition, there will be research aimed directly at the control of pests and diseases by cultural and chemical means, and by breeding.

Harvesting and Marketing. There are problems concerning the harvesting, cleaning, grading, packing, transporting, storing, and the handling of vegetables in the market which, to the commercial producer, are just as important as those connected with the growing of the crops. Investigation is needed in all these aspects of the business so that they may be improved and made more efficient. This will involve a study of the influence of these processes and methods on the ultimate quality of the vegetables, i.e., appearance, table quality, keeping quality, processing quality and nutrition value, and on wastage. Most of this work would be the responsibility of other research organizations more suitably equipped and staffed for this purpose, but we would keep in close touch with their work and would co-operate where necessary.

Mechanization. Mechanization has changed the whole outlook of crop production. Machines can do some work more cheaply, more quickly or more efficiently than either hand- or horse-labour ; moreover, they can do with ease some work which could scarcely be tackled previously. The machine has not yet been fully exploited, however. This is appreciated by the new Horticultural Section of

the National Institute of Agricultural Engineering, which will deal with such matters. The N.I.A.E. recognizes also that there is a great need for small-scale mechanized units specially designed for market gardeners and smallholders, and research on these lines is in progress. The National Vegetable Research Station will collaborate closely with the N.I.A.E. Particular regard will be paid to the need for developing machines for special work; and the station will test experimentally machines produced by the N.I.A.E. and, if necessary, devise modifications in cultural technique to match the performance of the machines.

The National Agricultural Advisory Service and the National Vegetable Research Station

Seasons differ; the climate and the soils also vary in different localities. These differences can have remarkable effects on crops, and, for these reasons, methods of crop production have been developed along different lines to meet these different effects. For the same reasons, certain crops are highly localized and so also are certain varieties.

It is clear, therefore, that one research station, the N.V.R.S. in this instance, cannot be expected to produce results (technique or variety or whatever it may be) which will be applicable to widely different parts of the country. This difficulty will be overcome, however, by the arrangements which have been made for close co-operation between the research station and the five Experimental Horticulture stations, together with sub-stations and demonstration stations of the N.A.A.S., which are being set up in various parts of the country.* At the research station we shall carry out the more fundamental research and the initial investigations or pilot experiments and, when the results from this work have sufficiently clarified the position, the experiments will be extended to the N.A.A.S. stations. There the results will be obtained under the different environments, and modifications of the treatments under test may be made if necessary.

In some instances it will be essential to carry out the whole of the research at an experimental station or, if necessary, at a special sub-station set up for the purpose in the region where the crop and its problem is localized. For example, watercress problems should be investigated in a watercress area and the breeding of broccoli for Cornish conditions should be done in Cornwall.

With this set-up, the benefits of research as applied to vegetable production should become available to growers and consumers throughout the country. Its success in this respect, however, will be dependent largely on the efforts and enthusiasm of the officers of the N.A.A.S.; they must form the two-way bridge for the passage of information between the research worker and the grower.

*See No. 4 of this Review (p.161).

EFFECTIVE PUBLIC SPEAKING

V. MALLINSON

Lecturer in Education, Reading University

Public speaking is an art, and unless this first premise is kept clearly in mind, little or no improvement in technique can be looked for. We cannot all be first-class speakers, but we can make the best possible use of the talent we do possess, and there is absolutely no reason why any speaker—however poorly gifted—should be inaudible, rambling or inconsequential. At the same time, no amount of coaching, no reading of manuals on the art of public speaking, no reading even of this paper, will do any good by itself. There must be a genuine desire to improve and be effective, springing from within the student—a kind of conversion, if I may put it that way.

Any public speech is propagandist—propagandist, that is to say, in the true meaning of the word and not in its debased present-day usage. True propaganda again is an art. Unfortunately many speakers, although having an intuitive apprehension of what good propaganda is, have not clearly thought out the issues involved, and thus they remain fundamentally ineffective. Propaganda falls into two clearly separated parts, and definitions here will, I feel, help :

(1) Propaganda is the art of persuasion with a view to inducing a *state of mind.*

(2) Propaganda is the art of persuasion with a view to producing *action.*

Many speakers make the mistake of trying to produce action without first having induced the necessary state of mind receptive to the action elements involved. This is fatal and nearly always fosters an antagonistic, or at the best a negative, attitude on the part of the audience. I would go so far as to say that this working on definition (2) before the ground has been thoroughly prepared via definition (1) is the root cause of failure on the part even of many public figures who are regarded as sound orators.

So to the preparation of the speech itself. Here the art which conceals art is all-important. No speech that is to be effective can be thrown together on the spur of the moment. Long practice will reduce preparation time to a minimum, and the routine tricks will become instinctive, but they must first be mastered. " The proper study of mankind is man," said Pope, and the speaker must make himself familiar with the individual traits of all kinds of audiences and be able to play with them much as the music hall artiste handles his public. To do this, it is advisable in making the rough draft of the speech to answer for oneself as fully as possible the following six questions :

(1) *What* exactly am I trying to sell ?

(2) To *whom* am I trying to sell it ? (See paragraph below on this.)

(3) *Why* am I trying to sell it ?

(4) *When* am I trying to sell it ? (i.e., At what time of day—this has an important psychological effect, and the general temper of the whole speech must be conditioned by this.)

(5) *Where* am I trying to sell it ? (What size of room ? Is it outdoor or indoor ?)

(6) What is the expected result ?

As to the question : To whom am I trying to sell it ?—it is important here to remember that any social group represents in its members three permanent characteristics, so to speak, and three temporary ones, i.e., characteristics susceptible to change. The permanent characteristics are : age, sex and habitat (the sort of surroundings one generally lives in—a predilection based really on prejudice). The temporary characteristics are : politics, religion and domicile (i.e., the actual locality—the working-class district, alongside the river, the business centre of the town, etc.).

When the speech is prepared, the question of delivery must be considered. Here, nothing but general principles can be noted ; one's own personal idiosyncrasies should be exploited, but irritating habits, gestures and mannerisms rooted out. The audience should be made to feel that the speaker has a genuine interest in each and every one of them, and this means " a roving eye " put to intelligent and effective use. There is only one golden rule : if you don't know what to do, then don't do it. Remember, too, that a straight line is the shortest distance between two points, and, if you must move about, don't wander aimlessly. In fact, if you move you should have a specific reason for so doing. This does not, of course, mean that you should remain statuesque.

Finally, always be clear, methodical and business-like. The following true story was once told me by a man who is now a leading London producer : " When I was a raw undergraduate at Oxford," he said, " I decided to become a theatrical producer. In great fear and trembling I seized a unique occasion to get into conversation with . . . (here he mentioned a very famous theatrical personality, old enough to be his father). I asked him what I should do to become a producer. The great man looked me up and down and said finally : ' Produce, young man ! Produce ! ' and walked away. I took his advice."

Dare I hope that *you* will take mine ? I would add simply this : the best visual aid still is the speaker's own bearing and personality.

ABSTRACTS

ANIMAL NUTRITION

Grassland and Health

In October, 1948, the National Veterinary Medical Association organized a paper-reading conference concerning the Relationship of Grassland and Animal Health. This conference gave an opportunity for veterinarians, agronomists, plant breeders and workers in animal nutrition to meet and examine the health and nutritional implications of recent advances in grassland husbandry. A report of the proceedings has been published by the National Veterinary Medical Association (*N.V.M.A. Publication No.* 17).

Several of the papers read were of direct interest from the nutrition standpoint. It is possible to deal with only one paper in these notes, namely that by Dr. H. H. Green, " Major and Minor Elements in Relation to Animal Health and Pasture Management," which covered existing knowledge in this important field. Two other contributions were, however, of great interest : " The Oestrogenic Factor in Subterranean Clover in Australia " by D. H. Curnow and " A Factor in Pastures Affecting Muscle Activity " by W. S. Ferguson. In both, reports were made of recent researches into the causes of certain diseases associated with pasture : Mr. Curnow dealt with infertility, dystosia and prolapsus in sheep, and Mr. Ferguson with the search for the substance in grasses and clovers responsible for causing bloat in cattle.

Dr. Green dealt first with the major elements of calcium and phosphorus ; he distinguished between two types of disorders associated with these two elements, namely, those arising from shortages in the diet and those due to dysfunction of the body's physiological mechanisms for dealing with these substances. Acalcicosis and aphosphorosis, diseases that reflect a true dietary deficiency of calcium and phosphorus, rarely occur in animals on pasture except where the soil is acutely deficient in phosphorus. This situation occurs notably in areas in South Africa ; also the disease has been identified in the Western Highlands and is known to occur on certain poor grazings in England and Wales. He stated that it is doubtful whether " straight acalcicosis " ever occurs amongst animals confined to natural grazing, since, usually, the vegetative parts of plants are rich in calcium. Normally, any programme of pasture improvement would include the use of phosphatic fertilizers together with dressings of lime where these are required. Such measures will automatically adjust the levels of calcium and phosphorus in the herbage and so preclude deficiencies in the diet of grass-fed animals. On marginal land where improvement would be uneconomic, the use of mineral mixtures offers a solution.

The view was expressed that so far as magnesium is concerned there is no possibility of nutritional deficiency of the element with the grazing animal. The diseases that are associated with the low blood magnesium,

e.g., hypomagnesaemic tetany, are related to some form of physiological dysfunction and not to the level of magnesium in the pasture. Nothing is known at present of the association between grass and the disease. Iron and iodine deficiencies in Britain are extremely rare in animals which have access to grass, and grass always appears to contain sufficient manganese for the grazing animal.

Just over ten years ago investigations in Britain on lines similar to those that had been going on in Australia and New Zealand led to the discovery that herbage over quite large areas in certain parts of Scotland and on the granitic soils of Devon and Cornwall suffered from cobalt deficiency. Earlier, as in Australia, the wasting disease of sheep had been associated with iron deficiency, but further investigation showed that the benefits accruing from the feeding of iron supplements was due to cobalt which was present as an impurity in the iron compounds used. Definite levels of cobalt, both in the herbage and as available cobalt in the soil, below which cobalt deficiency is likely to occur, have been established. One very interesting point has been noted : the effects of cobalt deficiency are exhibited by ruminants alone ; this subject is under active investigation at the present time.

Dr. Green ended his paper with a consideration of the rôles played by copper and molybdenum in pasture grass. So far as copper is concerned, he pointed out that low values of copper in the dry matter of pastures are associated with " falling disease " of cattle and " enzootic ataxia " in lambs in Australia and also with " reclamation disease " and " liksucht " in Holland. All these conditions can be alleviated by dressing the pastures concerned with amounts of copper sulphate as low as 10 lb. per acre. In Britain, however, the swayback disease in lambs, common in some parts of Derbyshire, occurs on pastures containing normal, or higher than normal, amounts of copper, despite the fact that the copper content of the blood of the lambs' mothers is subnormal. In this instance dressing the pasture with a copper salt would have no beneficial results and recourse must be had to direct administration of copper salts to the ewe prior to lambing.

For some years it has been known that the consumption of herbage containing abnormally high amounts of molybdenum brings about severe scouring in cattle. In Britain this condition is confined to certain so-called " teart soils " in Somerset and smaller areas in Gloucestershire and Warwickshire. The scouring may be stopped by administration of copper sulphate, either alone or as a food supplement. Research has shown that the copper has no effect in reducing the absorption of molybdenum, since the levels remain high both in the blood and urine. Dr. Green's conclusion is that although the mechanism of the scouring effect of molybdenum is imperfectly understood, it has to do only with the alimentary tract and can be prevented and cured by the therapeutic use of copper sulphate.

R.G.B.

ANIMAL BREEDING

The Breeding Season of the Sheep, with Particular Reference to its Modification by Artificial Means using Light. Yeates, N. T. M. *J. Agric. Sci.*, **39** (1949), 1.

Usually, in the British Isles, ewes are mated in the autumn and winter months, spring lambing not being considered a disadvantage. However, in some countries an autumn lambing is desired, as at this time the pastures are at their best and blow flies and internal parasites are less troublesome. Also it would be an advantage in such countries as America if the fat sucker lamb trade could be continued all the year round.

It has been shown that the breeding season in the ferret is controlled by the length of day and that light is the effective agent that causes the activity of the anterior pituitary; in order to investigate this subject further, work was started with breeding ewes in September, 1946.

Twenty-four Suffolk × Border Leicester-Cheviot breeding ewes were selected and divided into two groups. The control group ewes were treated in the normal way and they began to come in season in September, some 10-14 weeks after the longest day. Four of these were mated and the remainder came in season regularly until the end of March, some 10 to 14 weeks after the shortest day.

The experimental group ewes were subjected to artificial electric light in such a way that they received increasing hours of light from October to January. Prior to the introduction of the light three ewes of this group were also mated, the remaining non-pregnant ewes ceased coming in season two months before the control group, which was 10-14 weeks after their shortest day in October. The experimental ewes then had their hours of light reduced from the end of January, when they had 21 hours of light, to 14 hours by March 21 and to $5\frac{1}{2}$ hours by the third week of June. During this latter period the light was limited by placing the ewes in a pen suitably blacked-out. The ewes started to come into season again in May, including those that had lambed some 10 weeks previously, and in 22 days all 12 experimental ewes had been served, including the three that had lambed the previous March, one of which was still suckling twin lambs.

A further group of ewes, that had been under the influence of naturally increasing daylight, was introduced into the experiment on March 23. Those that joined the control group were to continue to have increasing light, whilst those joining the experimental group were to have reduced hours of light. This second lot of ewes began to come in season on June 28, again 10-14 weeks after their longest day.

From this work it would appear that the seasonal change in the length of day is the chief factor in determining the onset and duration of the sexual season in sheep. This natural breeding season can be modified or even reversed by altering artificially the length of daylight. A change from increasing to decreasing hours of light promotes breeding and the response comes approximately 10-14 weeks after the longest day. This period of breeding, if not interrupted by pregnancy, will continue until

10-14 weeks after the shortest day. It is also evident that it is the change from increasing to decreasing hours of light, and not the actual number of hours of light, which is the deciding factor.

Under natural conditions, the ability of ewes of some breeds to produce two crops of lambs in a year depends on the duration of their sexual season. This season may be interrupted only for a short space by lactation anoestrus, whilst the lambs are sucking, and then the sexual cycle continues again until the end of their breeding season. It is during this latter time that the ewe might again be served.

Seasonal variation in the fertility of rams also appears to be controlled by light, with a decline in vigour during the summer period.

This work would appear to prove that the value of " flushing " lies merely in increasing the percentage of twinning and not, as was previously supposed, in accelerating the onset of the sexual season.

W.L.

SOILS

Fertilizer Placement

R. O. Miles (*Jealott's Hill Bull.* No. 4 (1947)) points out that experience in this country has shown that the concentration of fertilizers near the seed by means of a combine drill has the following advantages, as compared with broadcast distribution :

1. Saving in labour by adding fertilizer and sowing the seed in one operation ;
2. Increase of crop yield, particularly with cereals in which plant tillering is increased ;
3. Reduction in weed growth (often a major factor determining crop yield) ;
4. Reduced phosphate fixation in the soil ;
5. Better establishment and earlier growth ;
6. Earlier horse hoeing is possible for roots ;
7. Earlier ripening of cereal crops ;
8. Increased resistance to wireworm attack.

Of course, it does not follow that all these advantages are obtained by all crops under all conditions ; it means that some of them can be obtained with some crops under some conditions.

During the recent war, the need for greater food production and the shortage of labour gave considerable impetus to the practice of combine drilling ; many combine drills were imported and these were supplemented later by British-made machines. Thus, the number of combine drills in use in this country in successive two-year census periods were 7,930 in 1942 ; 12,720 in 1944 ; 17,037 in 1946, and 20,731 in 1948.

Most combine drills are designed primarily for use with cereal grain, which is much less prone to injury from direct contact with fertilizers

than, for example, seeds of root crops. Experience shows that the drill should have separate hoppers for the seed and for the fertilizer, though in some types both seed and fertilizer may reach the soil through a common coulter. It is significant, however, that the earliest type of combine drill in this country which was developed by Fenland farmers for use with roots has separate coulters for seed and fertilizer ; the coulters are arranged so that the fertilizer is deposited before the seed, the fertilizer being partly covered with soil before the seed reaches the ground. Thus direct contact of seed and fertilizer is avoided.

An extensive series of trials of the combine drilling of cereals was carried out in England and Scotland in 1943-44. On the average, in these experiments $1\frac{1}{2}$ cwt. of superphosphate drilled with the seed was as good as 3 cwt. broadcast. Yields on very phosphate-deficient soils were, in a few experiments, several times greater than yields from broadcast superphosphate. On some light chalky soils in southern England, small dressings of potash drilled with the seed gave a good crop whilst the same dressing broadcast has been of little value. As heavy dressings of fertilizer containing much soluble salts may damage germination, not more than 3 cwt. per acre should be combine-drilled for cereals.

The most striking results obtained with combine drilling have been obtained where the land is deficient in a particular nutrient, e.g., on poor, phosphate-starved soils. Seeds of root crops and also peas and beans seem to be sensitive to direct contact with fertilizer, particularly under dry conditions. Experiments with side band placement (following American practice) with roots show that this type of placement has marked advantages over broadcasting fertilizer on soils very deficient in one or more nutrients. In many instances the root range of the crop is greater than the top 9 in. of soil. Thus it may not always be best to incorporate all the fertilizer near the surface. It has been demonstrated, for instance, that sugar beet crops can benefit considerably from ploughing in phosphates and potash before preparing the seedbed.

Much attention has been given in America to placement of fertilizers for potatoes. In this country it has been found that if dung and artificials are applied to the bottom of the potato drills better yields are obtained than with the usual practice of broadcasting fertilizer over the whole surface of the ridges. The poorest yields of all are obtained when fertilizer is broadcast over the field before opening up the ridges. British practice automatically ensures good fertilizer placement for potatoes, and there appears to be little advantage in using special placement machines.

A special application of the principle of fertilizer placement is reflected in the interesting work of Winifred O. Roberts (*J. Agric. Sci.*, **38** (1948), 458-68) on economizing in the use of fertilizers on deficient soil by soaking cereal seeds in nutrient solutions before sowing. Field trials showed that soaking oats in tribasic potassium phosphate solution increased the yield of grain and straw on phosphate-deficient soil by 46 per cent (untreated seeds 17 cwt. per acre, soaked seeds 25 cwt. per acre) at the cost of 4.6 lb. of P_2O_5 per acre, without the addition of any

phosphate to the soil. This treatment may prove of value over wide areas of phosphate deficient soils, especially where a combine drill is not available.

A.J.L.L.
W.M.D.

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MACHINERY

Potato-planting and Harvesting Machinery

Potato Planters. Mechanization of potato-planting was of little interest to British farmers until the need arose for an expanded potato acreage during the recent war period. New types of potato planter were developed ; at first these were used mainly by farmers who were newcomers to commercial potato-growing. Since, British manufacturers have so improved the machinery available that the use of planters has now extended into such potato-growing areas as the Fens. " Potato Planting Machinery " (*British Farm Mechanization* (May, 1949)) deals with the machines taking part in a demonstration in Lincolnshire. Eight types of potato planter are described, and reference is made to the fact that most of the machines demonstrated dealt fairly effectively with chitted seed, while spacing was good on the whole. It is observed that the trend is towards non-fertilizing planters, which is a little puzzling in view of the now well-proved fact that the broadcasting of fertilizer on the flat before planting does not give results as good as either spreading over the ridges after the furrows have been opened or suitable band placement near the seed but not in contact with it.

Many of the machines taking part in the demonstration were of the two-row tractor-mounted type, and the use of light metals and tubular steel in the design receives favourable comment. Another commendable feature observed in one machine is the standardization of two sizes of nuts throughout the planter. On the whole, potato planters are a good example of the way in which the British agricultural engineering industry is advancing in skill and ingenuity of design.

Developments in potato-growing machinery abroad include various devices for getting rid of haulm before lifting. *The Mechanization of Potato Growing* is the subject of a well illustrated booklet (in Danish) produced by a Danish distilling company (Aktieselskabet De Danske Spritfabriker). All aspects of potato-growing are dealt with, and both Danish and foreign machines are discussed. Among the machines

mentioned is the " Roto-beater," an American machine for pulverising potato tops before harvesting. It consists of a device resembling a rotary cultivator, with rubber flails mounted on a horizontal shaft that is driven at high speed from the tractor p.t.o. In some parts of the United States and Canada, the use of these machines is preferred to spraying with a haulm-killing chemical.

A less promising method of dealing with potato haulm is by burning it. In notes on the French Salon de la Machine Agricole (*Farm Implement and Machinery Review*, **75** (May, 1949), 80) mention is made of a stubble and haulm burner, and more details are given in *Motorisation Agricole* (April, 1949), 255. The flame gun dealt with consists of eight burners arranged to defoliate four rows at a time.

POTATO HARVESTING MACHINERY. Development work on potato harvesters is proceeding at the N.I.A.E., and the research involved is described in four articles published in *Agricultural Engineering Record*, (" Potato Lifting Shares " : Summer, 1947. " Separation of Soil from Potatoes " : Autumn, 1947. " Separation of Stones from Potatoes " : Winter, 1947-48. " Separation of Haulm and Weeds in Potato Harvesting " : Spring, 1949). Each article gives a concise account of the experimental work done and conclusions drawn. Some of the methods tried were found useless ; sometimes, however, negative results are as important as positive ones, and it is to be hoped that inventors who wish to develop potato harvesters will first read such articles before putting their own ideas to the test.

Among the more significant conclusions reached are the following :

(1) A single soil driven, large-diameter concave disc, suitably set, makes an effective and trouble-free share, and is well suited for use in conjunction with a " shaker-type " separating mechanism. The amount of soil lifted with the tubers is less than with conventional types of share, and the work of the soil-separating mechanism is therefore lightened.

(2) Haulm and weeds can effectively be removed by fitting suitably shaped raised bars above the second grid of a double-grid shaker digger.

(3) While the problem of separating stones from potatoes remains unsolved, some progress towards a solution has been made, utilising strips of rubber on the periphery of a driven drum. The resistance to bending of the rubber strips can be varied by varying the drum speed, and at suitable speeds stones tend to bend the strips and pass through into the drum, while potatoes tend to pass on over the outside. While this method showed promise when a well-regulated and sparse supply of stones and potatoes was fed to the drum, the problem of dealing with heavy crops at a reasonable rate in the field remains unsolved.

There has been little published to date on the economic aspects of using various types of potato harvesting machinery. J. A. Stodart (*Farming News*, 6.2.48, p. 3) found an appreciable saving of labour by use of an elevator digger compared with a spinner, and general experience shows a saving of some 10-20 per cent in labour cost. There is, however, the disadvantage that first cost and maintenance expenses on elevator diggers are high on some types of soil, while in adverse conditions

such as occurred in the late autumn of 1948, elevator diggers may fail completely while spinners will operate satisfactorily.

The use of " complete " potato harvesters is steadily increasing, but published information to date consists mainly of descriptions of individual machines, with little or no reliable information on their performance. In ideal conditions for the use of complete harvesters (as in parts of the Fens) the cost of mechanization is obviously well justified, for a potato harvester with two men riding on it can do as much work in a day as is done by a gang of 8-10 men working after an elevator digger. In other conditions, however, where stones and clods are a serious problem, it may be impossible to do satisfactory work even with half a dozen men riding on the harvester.

Mechanization of Sugar Beet Growing

Progress in the mechanization of beet growing at home is comprehensively surveyed by Oswald Rose in the *Report on Mechanization of the Sugar Beet Crop in Great Britain during the year* 1948, issued in booklet form by the British Sugar Corporation Ltd. From this clear account of the machines used and work done many significant trends emerge, among which are the following :

Drilling. 25 per cent of the total acreage (400,000 acres) was drilled by some 5,000 tractor drawn, tractor mounted, or self-propelled drills. This figure was almost identical with that for 1947. Some of the old types of drills converted to tractor use were found unsatisfactory, but most of the 118 self-propelled drills used received very favourable comment.

Cross-blocking. The acreage treated in this way further declined to only 1,005 acres or 0.25 per cent of the total. There were, however, two cases of outstanding success achieved by self-propelled hoeing units.

Hoeing. There was a further increase in the use of tractor hoes, 6,884 growers using 4,942 rear-mounted or trailed tractor hoes, 1,427 mid-mounted or underslung attachments, 294 forward-mounted attachments and 221 self-propelled hoes. The self-propelled hoes were particularly successful after drilling with the same tool-chassis.

Harvesting. 396 harvesters were operated last season, and altogether they harvested 13,676 acres or 3.4 per cent of the crop. This was more than double the area dealt with in 1947. A number of additional harvesters were delivered too late to work. The report generally indicates that sugar beet harvesters are now on a commercial basis, for over 100 machines each harvested between 50 and 100 acres—an indication of much improved reliability. The report shows that a quarter of the harvesters, owned by farmers with only 10-25 acres of their own beet, did contract work on other farms when the work at home was finished.

The importance of good servicing facilities and instruction is emphasized, and the Report further deals with preservation of tops, costs of operation, field pick-up loaders, elevators, and the 1948 demonstrations.

Details of harvesters in use last year are given in an article in the

Agricultural Machinery Journal (Nov.-Dec., 1948). This article describes the machines shown at various demonstrations last autumn, and indicates that improved toppers and simplified design were the outstanding features. A further account of this machinery is given by H. J. Hine (Harvesting Sugar Beet : Recent Demonstrations, *Agriculture*, **55,** 9 (1948), 385-7).

In an article by A. P. Bevan (Beet Harvester Design, *Farm Mechanization* (Nov.-Dec., 1948)) the author deals with the difficulties met with in harvesting beet, the factors affecting overall design of a harvester, and the separate operations which constitute beet harvesting. He stresses the importance of first perfecting a machine for each individual operation before embarking on the design of a complete harvester, and considers that the system of splitting up the harvesting operation into several stages is worthy of more attention in this country.

If the 1948 demonstrations had achieved nothing else they would have been worth while in that they clearly showed that the harvesting job can satisfactorily be divided into two distinct jobs, viz., topping and lifting, and that the machines needed for both of these jobs can be simple and cheap.

An article " Sugar Beet Harvester Development " (*Agricultural Engineering Record* (Summer, 1948)) gives an account of research work at N.I.A.E. in 1947-48 dealing with trials of three types of topper-picker. One of these has been further developed into an efficient mechanism, and in view of the necessity of saving tops for fodder, this type of topper may become of great importance in future.

Development of satisfactory complete sugar beet harvesters has been a long-term job, a point emphasized in an article by H. B. Walker, (A Résumé of Sixteen Years of Research in Sugar Beet Mechanization, *Agricultural Engineering* (Oct., 1948)) in which he covers the work done at the California Agricultural Experiment Station since 1921. The article deals also with cross-blocking, planters, and seed-processing, and states that processed seeds are now used for 90 per cent or more of the total sugar beet acreage in the U.S.A. He shows that the publicity given to harvester investigations through subsidized research attracted inventors and commercial companies to develop experimental harvesters, and that the pace of this research work was stepped up during the war years when growers began to accept the idea of mechanical harvesters, until, by 1947, 65 per cent of California's sugar beet was harvested mechanically.

R. Bainer, in a survey of progress in the U.S.A. (Latest Developments in Sugar Beet Harvesting, *Farm Implement and Machinery Review* (May, 1948)) estimates that beet mechanization in California has cut down the overall labour requirement of the crop from 105 to 35 man hours per acre, and mentions much lower figures for the non-irrigated areas such as the Red River Valley area of Minnesota.

In the United States and in Canada there is now a tendency to use decorticated or rubbed seed instead of segmented. The results of extensive trials with segmented seed in Britain are described by S. Culpin (Segmented Sugar-Beet Seed Trials, *Agricultural Engineering Record*

(Winter, 1947-48)). It seems most unlikely that segmented seed will now be used on a commercial scale in Britain, but recent results with " decorticated " seed are so promising that this treatment seems likely to be adopted on a widespread scale if and when the treated seed is made available.

In a report of the Danish Academy of Technical Sciences entitled *Mechanization of Sugar Beet Cultivation* (*Beretning fra Udvalget vedrørende Mekanisering af Sukkerroedyrkning*) there is an account by Knud Hansen of the development of sugar beet lifting machinery in Denmark since 1920, and very comprehensive and critical descriptions of the machinery at work at the British demonstrations organized by the British Sugar Beet Corporation in 1946, 1947 and 1948. These accounts give a very fair idea of the performance of each machine and indicate its probable value in Denmark, where is it evidently imperative that the tops should be harvested in good condition for stock feeding. There is also a survey of Danish patents taken out since 1927 in respect of beet lifters and beet topping machines.

C.C.

FRUIT

Out-of-season Strawberries

The production of strawberries in early spring in heated greenhouses or under cloches usually shows good returns for those who manage their plants carefully, but in Britain little attempt has been made to grow strawberries to ripen after the normal field crop, especially during the autumn and winter. Research in America and Holland during the past fifteen years or so has shown that the development of the strawberry plant is influenced by the amount of daily light and warmth the plant receives. A few years ago Z. W. B. van den Muijzenberg collated the existing knowledge, much of it his own work, and laid down programmes for artificially controlling light and temperature so that strawberries could be produced throughout the year (*Meded. Lab. TuinbPl. Wageningen*, **37** (1942)).*

Under normal conditions flowers are initiated in late August and September as the days become shorter. Further development is slow during the autumn owing, probably, to low temperatures and perhaps drought, and is followed by the winter " rest period ". The rest period is broken by the lengthening days and rising temperatures in spring, and by May the flowers are forming. As the days lengthen further and temperatures rise runner production begins.

The main factors appear to be : (*a*) Short days favour flower initiation and inhibit runner production, and (*b*) high temperatures favour runner production and inhibit flower initiation unless the days are short.

*Since this abstract was written a similar article by the same author has appeared in *Le Bulletin Horticole*, **4** (1949), 283-8.

The following programmes have proved effective with the variety *Deutsch Evern* in Holland but may require modification for English varieties and conditions :

1. Early Autumn Fruit. Plants producing runners are darkened for ten hours per day for six weeks (summer short-day treatment) from the middle of May to the end of June ; the runners are planted out in July in frames, which are covered in August or early September, to produce ripe fruit from the middle of August until October.

2. Autumn Fruit. The runners are planted out in a frame (wired for electric heating) in July and darkened for ten hours each day for six weeks. From mid-August onwards the days are lengthened by illumination of 100 candlepower at the plants from electric incandescent lamps, and in October the frames are heated. The fruit ripens during October and November.

3. Early Winter Fruit. The plants are given short days for three to four weeks in August. In mid-September they are brought into a glasshouse, which is heated from October onwards, and are illuminated for eight hours per night with at least 400-500 candlepower at the plants, using either neon or electric incandescent lamps. This strong lighting is used to increase photosynthesis as well as to lengthen the day. The fruit ripens mainly during December or January.

4. Winter Fruit. Flower initiation takes place at the natural day length, then in the second half of September the plants are taken into the greenhouse and given illumination of at least 400-500 candlepower for eight hours per night. Later heat is applied, and the fruit ripens in January and February.

5. Late Winter Fruit. Normal initiation can be checked by lengthening the days by artificial light from about August 10 until the end of September, the plants being kept under glass from the beginning of September. In October they are kept for three to four weeks in the natural (short) day length before being placed in a heated house and illuminated for eight hours (11 p.m.-7 a.m.) by neon lamps. The fruit ripens from February onwards.

The same result can be obtained by an alternative method. The plants are kept at 32° F. from the middle or end of September to the beginning of November. Then they are placed in a heated house and given strong illumination.

6. Early Spring Fruit. Plants without special treatment are forced from mid-January onwards, when the normal rest period is over, and fruit is picked in March and April. This is the usual practice in Britain.

7 and 8. Spring and Summer Fruit. The normal culture under cloches or cold frames produces fruit in May and early June, and in the open produces it in June and July.

9. Late Summer Fruit. Ripe fruit in July and August can be produced by prolonging the winter rest period by keeping the plants at 32° F. from the beginning of March to the beginning of May, after which the plants are brought into the open—at first into shade and later into full light. Alternatively, fruit in July can be obtained as a second

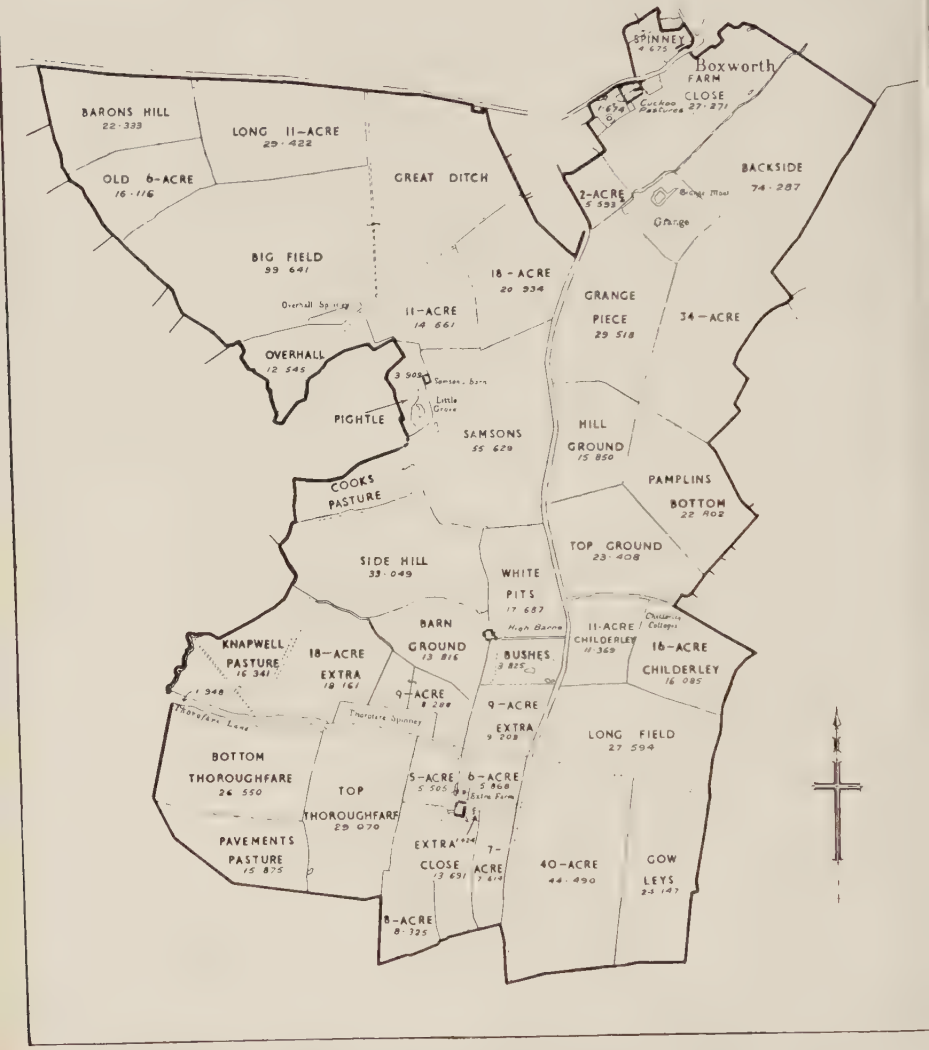
1. Aerial view of Boxworth Experimental Husbandry Farm towards the West (July, 1949). The main set of farm buildings is just off the lower right-hand corner of the photograph.

2. Barns, drier house and open yard at Cuckoo Pastures.

3. High Barns Farm.

4. Open yard at High Barns Farm.

5. Open yards and loose boxes at Extra Farm.



6. Map of Boxworth Experimental Husbandry Farm, Showing Ordnance Survey reference and acreage of each field.

crop from plants used for early spring fruit (6) by allowing natural flower initiation to take place in the short days of early spring.

Combinations of treatments can be used to produce more than one crop during the year from the same plants ; thus plants that have been grown in cold frames (7) can be given short-day treatment (10 hours) for three to six weeks in May and/or June and produce a second crop in the autumn. Runners from plants treated in this way, which with treatment 1 would crop first from August to October, can be induced to give a second crop in the following spring in frames (7). If they are then given a short-day treatment in early summer, a third crop in autumn can be obtained. Naturally, close attention to the nutrition requirements of plants cropped in this way is necessary.

H.B.S.M.

NUTRITION OF HORTICULTURAL CROPS

Fertilizer Placement

Whilst the combine-drill has come to stay so far as agriculture is concerned, the advantages of fertilizer placement for horticultural use are, probably, limited. However, as fertilizers are playing an increasing part in intensive food production, an understanding of the principles involved, in so far as they affect the soil, the crop, design of machinery and the compounding of fertilizers, is essential for the technician and progressive grower. Experiments in this country with horticultural crops are confined to potatoes and roots. The following two abstracts indicate the extent of recent developments.

Fertilizer Placement for Arable Crops. Stewart, A. B. *D.O.A.S. Leaflet No.* 3 (1949).

This leaflet deals briefly with the fundamental principles of fertilizer placement, as opposed to broadcasting, and describes experiments carried out in England and Scotland to gain both qualitative and quantitative results. Using the oat crop to demonstrate the value of combine-drilling different fertilizers, superphosphate at $1\frac{1}{2}$ cwt. per acre gave the same yield as 3 cwt. broadcast ; combine-drilling or broadcasting $1\frac{1}{2}$ cwt. sulphate of ammonia gave exactly the same yields. Under Scottish conditions potash behaves like nitrogen but in England, particularly on the chalk soils, potash combine-drilled surpasses broadcasting. Fertilizer mixtures of NPK when drilled are superior to broadcasting, and for general purposes granulated fertilizers are recommended. Experiments on swedes and turnips in Scotland indicate that band placement of phosphate, either one inch below, or below and to the side of, the seed, give better results than broadcasting. A word of caution is given, contact placement or combine-drilling is likely to be dangerous when moisture is lacking.

Rotation experiments also are described, which were designed to compare over a complete rotation single dressings of phosphate combine-drilled with double dressings broadcast. The results agree similarly with the behaviour of individual crops.

Recent Developments in Fertilizer Placements. Cooke, G. W. *Farming*, **8** (1949), 8.

Mention is made of American work with horticultural crops using liquid fertilizers, such as " starter solutions," which are applied near the seed or plant at sowing or transplanting time. Also machines have been developed for supplying direct to the soil anhydrous ammonia, this being the most economical way of supplying nitrogen. The fertilizing of orchards or established crops with phosphate or potash, neither of which is readily washed down to the root zone, has led to the development of sub-soilers with fertilizer attachments which place a band of fertilizer in the root zone.

Experiments are described for potatoes and row-crops in eastern and southern England during 1945-47. Using powdered " National " fertilizer No. 1 at 5, 10 and 15 cwt. per acre, the fertilizer was either (*a*) broadcast before ridging, (*b*) broadcast after ridging, (*c*) placed in contact with the seed, or (*d*) placed in side bands 2 in. away from the centre of the furrow and 2 in. deep. The results from twenty-five experiments show that 10 cwt. of fertilizer broadcast before ridging will be required to produce yields equal to (*b*), (*c*), or (*d*) at 7 cwt. to the acre. These results apply especially to wet seasons ; during dry seasons damage occurred in contact placement treatments.

During 1947-48 experiments with peas, using a phosphate-potash fertilizer (10 per cent P_2O_5, 20 per cent K_2O) drilled in contact or in bands near the seed, showed that side-band placement gave an increase of 2 cwt. per acre on the same dressing when broadcast. Damage to germination was caused by direct placement.

In summing up the author points out that there is no point in departing from existing fertilizer practices in preference for placement methods unless increased yields, higher fertilizer efficiency and lower cost of production can be established.

W.P.

CROPS AND PLANT BREEDING

Oat Blast

A long-term study of blast in oats, reported by Rademacher (*Züchter*, **19** (1948), 1-6), showed that of the three German varieties investigated, *Carsten's IV* was least troubled by blast, *von Lochow's Yellow* was worse, and *Mahndorf's Victoria* had most blast. The ranking of the three varieties was quite consistent over a period of sixteen years at one station, and in one year at twenty different stations. The inevitable conclusion that the tendency to blast is inherited is supported by hybridization work. *Mahndorf Victoria*, the most susceptible variety, was also the most

variable in respect of blast ; also it regularly builds more spikelets than it is able to fill. There is some evidence that the percentage of blasted spikelets in *Mahndorf Victoria* increased in the course of sixteen years, but in the other two varieties no such trend was evident.

Rotation of Varieties

The value of crop rotation in reducing the incidence of crop diseases is a commonplace. Stevens (*Science*, **110** (1949), 49) has noticed the frequency with which new varieties become popular and then go down to a disease which did not trouble the older varieties they replaced. He suggests that by introducing a rotation of varieties resistant to different diseases, the build up of the pathogens might be reduced. This is a useful reminder of the need for caution and careful thought in connection with the restriction of varieties.

Sweet Clover

A review of breeding work with *Melilotus albus* and *M. officinalis* is given by Schröck (*Züchter*, **19** (1948), 59-68). The advantages of sweet clover are that it is easily suited in respect of soil and climate, and that it has vigorous growth and a high protein content. The disadvantages are stemminess, woodiness of the stems, poor recovery after cutting, lateness in spring growth, easily shed seed, and great susceptibility to mildew. Coumarin, though bitter, is not poisonous, but if sweet clover hay becomes heated in the making, an unknown toxic compound is produced from the coumarin ; the effect, when the hay is fed to cattle, is to lower the prothrombin content of the blood, and fatal bleeding may result. Strains with a low coumarin content have been selected in Germany and in Canada, although the coumarin content fluctuates widely. In each case a single recessive gene leads to low coumarin content. Another recessive gene produces bushy plants with many stems. These have the double advantage of greater leafiness and more aftermath production. Even in bush types, however, the second cut is much less than the first, while the spring growth does not start until lucerne is already about 6 in. high ; improvement in both these respects is therefore still needed. There is also room for improvement in resistance to mildew, which causes much loss of leaf, especially in *Alpha*, the Canadian bush type ; there is so much variation in the resistance of individual plants to mildew that it seems quite possible that resistance will be improved.

A Repellent for Deer

Probably a good fence is the best way of avoiding damage to crops by deer. A possible second line of defence is described by Baumgartner and Powell (*Contr. Boyce-Thompson Inst.*, **15** (1949), 411-20). A substance, called the zincdimethyldithiocarbamate-cyclohexamine complex, when sprayed on plants appears to make them distasteful to deer, though unfortunately the new growth put on after spraying may be browsed unless it is resprayed. The substance is believed to be harmless to plants and animals and is now available in the U.S.A. as a proprietary preparation. It would be most interesting to know whether this, or a

similar substance, would be effective against rabbits and hares. It is also of interest to note that its rather lengthy chemical name suggests an affinity with the group of substances which some people can and others cannot taste.

Ecology of Twitch

Further studies on competition between barley and twitch grasses at Woburn are reported by Mann and Barnes (*Ann. Appl. Biol*, **36** (1949), 273-81). They describe pot experiments in which varying numbers of barley plants and plants of a rhizomatous bent (*Agrostis gigantea* Roth. var. *dispar* (Michx.) Philipson) were grown with ample water and supplies of nitrogen, and their effects on each other's yield studied. This particular form of twitch spreads rapidly by rhizomes in the top 6 in. of soil and is slightly more easily eradicated than *Holcus mollis*. One striking difference between the creeping bent and the barley was the proportion of the total growth found under the soil—6 per cent in barley and 41 per cent in the bent. It was found that increasing the number of barley plants per pot reduced the crop loss due to competition from *Agrostis*, although even with close-planted barley a reduction of one quarter of the yield occurred. Comparison with earlier experiments of the same kind on barley and *Holcus mollis* showed that the latter is a more serious competitor of barley than the rhizomatous bent. Examination of the yields of individual barley plants showed that additional plants of barley reduced yield per plant more than did additional weed plants. Similarly, additional barley plants reduced the yield per single weed plant more than did additional weed plants.

New Barley Varieties

While we await the results of English trials of the numerous new varieties of barley, the information which is becoming available from trials in nearer continental countries may give some lead on this important problem. The Dutch National Committee for Malting Barley ran trials during 1944, 1945 and 1946 under varying conditions of nitrogenous manuring and studied the malting quality of the produce (*Meded. Nat. Com. Brouwgerst*, **14** (1948), 215-322). Combining the agricultural and malting qualities, they arrived at the following ranking : *Freya*, *Balder*, *Rigel*, *Haisa*, *Pajberg Drott*, *Kenia*, *Stella*, *Saxonia*.

Defects noted in these varieties were : *Freya*, too high a proportion of small grains ; *Haisa*, too much lodging on heavy soils ; *Rigel*, disease susceptibility ; *Stella*, too like *Kenia* to be registered as a new variety ; *Pajberg Drott* and *Saxonia* are retained in the trials for further experience, the rest being dropped with the exception of *Balder*, which was sown on a large scale in 1947. *Balder* is a high yielding, shorter-strawed, rather early-ripening variety bred by Weibull's of Landskrona, Sweden ; its outstanding characteristic is complete absence of red pigment, which gives its grain an attractive appearance, though it is here reported as inferior to *Kenia* in malting quality. The grain characteristics for the identification of these varieties (except *Rigel*) are given by Lindeman (*Meded. Nat. Com. Brouwgerst*, **13** (1947), 197-214), with photographs, a key in English, and an English summary.

Value of Awns in Cereals

Because awned and awnless varieties exist in most cereals and awns are an unmitigated nuisance at threshing time, the question of whether they serve any useful purpose is often raised. Usually, experiments in which awns were clipped off have indicated an advantage for the awned condition but whether it was owing to absence of mutilation was left in doubt. Suneson, Bayles and Fifield (*U.S.D.A. Circ.* 783 (1948), 8) have overcome this difficulty by the use of the back-cross technique. Starting with the awned wheat variety *Baart* and the awnless variety *Onas*, they produced an awnless *Baart* and an awned *Onas* and compared awned with awnless at sixteen stations in western U.S.A. and two in Canada during the three years 1943-45. Both under irrigation and on dry land the awned forms showed advantages of, on the average, 2-4 bushels per acre in yield, $1\frac{1}{2}$-$2\frac{1}{2}$ mg. in grain weight, and 1 lb. in bushel weight. In milling and baking tests the related forms were very similar. The workers conclude that there would be an advantage in replacing the awnless *Onas* by the awned derivative.

Milling Quality in Wheat

Reference has already been made in this Review (**1,** 3 (1949), 119) to Berg's study of grittiness as a measure of milling quality. Greer (*J. agric. Sci.*, **39** (1949), 125-7) has tested the wheat varieties of the N.I.A.B. "Recommended List" and finds that *Holdfast*, *Redman*, *Warden*, *Yeoman* and *Rivet* have gritty endosperm. Apart from the *Triticum turgidum* variety *Rivet*, all these could have derived their grittiness from *Red Fife*. Greer also tested fourteen of Engledow's W.298 series (red-grained segregates from *Holdfast* x *Squarehead's Master*); eight of these were found to be gritty.

Oat Breeding

The relative instability of lines derived from crosses between spring and winter oats is well illustrated by Hunter and Carson (*J. agric. Sci.*, **39** (1949), 119-24). Off-types appearing in later generations from the cross *Argentine* x *Grey Winter* included "grass clumps" (very late-flowering), erect spikelets and aberrant grain colours. One of the latter was turned to good use, for it became the parent of *Picton*. The authors suggest that winter oats derive from crosses between *Avena sativa* and *A. byzantina*. If this is true, then crosses between spring and winter oats are something in the nature of interspecific crosses ; this would help to explain their irregularities in breeding behaviour.

Field Bindweed

Useful information on the control of *Convolvulus arvensis* under American conditions is given by Timmons (*Agron. J.*, **41** (1949), 130-3). Close-drilled annual crops tend to smother the seedlings and prevent their establishing themselves as perennial plants. Row crops and perennial grasses, on the other hand, do allow establishment. On land infested with bindweed there is danger in growing row-crops or perennial grasses in successive years. The principle to be observed in reducing bindweed by cultivation is to cultivate at least once a month during the

growing season : in particular, wheat stubble should never be left uncultivated until the following spring.

Selective Weed-killers

The results of preliminary trials in Belgium with various selective weed-killers are reported by Lacroix, dealing with oats and flax (*Rev. Agric. Bruxelles*, **2** (1949), 228-42), by Moes, dealing with barley (*Ib.*, 243-6), and by Noulard, who deals with wheat (*Ib.*, 247-52). These experiments are of special interest because of the resemblance to English conditions. Commercial preparations of 2-methyl-4-chlorophenoxyacetic acid (MCPA), 2,4-dichlorophenoxyacetic acid (2,4-D) or their salts, and nitro-dyes of the DNOC types were used. With oats and wheat the MCPA preparation used was effective as a weed-killer and had the least harmful effects on the crops. The sodium salt of 2,4-D was an effective weed-killer but had adverse effects on the crop, including the production of branched ears in wheat and sometimes significant decreases in yield in oats. The triethanolamine salt of 2,4-D was less effective as a weed-killer but had no effect on crop yields in oats. The dinitro-dyes were useful against yellow charlock but less effective against other weeds ; ammonium dinitroorthobutylphenate was the most effective of this type of weed-killer. Treatment of spring barley with sodium 2,4-D caused severe damage to the barley, with the production of many extraordinary abnormalities in the ears. Only the nitro-dyes were tried with flax ; they all caused some damage to the flax, and some preparations had little effect on the weeds. For details of treatments and names of the proprietary compounds used, reference should be made to the original papers.

An addition to the rapidly growing list of selective weed-killers is reported by Baumgartner and Wolf (*Contr. Boyce-Thompson Inst.*, **15** (1949), 403-9). Sodium isopropylxanthate (SIX) has a high solubility in water, and at 10-12 lb. per acre as dust or spray selectively killed many annual weeds (but not henbit (*Lamium amplexicaule*) or crabgrass (*Digitaria* sp.)) in peas, beans (*Phaseolus*), and cabbage.

Prince and Blood (*Agron. J.*, **41** (1949), 219-20) sprayed different varieties of potatoes in New Hampshire with the butyl ester of 2,4-D, the rates being given as 0.5, 1.0 and 1.5 pints of 40 per cent preparation. They observed a 10 per cent decrease in yield for each half-pint applied. Using the specific gravity test for quality (this test correlates with degree of mealiness of the boiled potatoes), they found an average improvement of rating of 10 per cent for the 0.5 pint treatment, nearly 7 per cent for the 1.0 pint treatment and a slight reduction in rating for the 1.5 pint treatment.

The response of different linseed varieties to 2,4-D has been tested by Tandon (*Agron. J.*, **41** (1949), 213-8). He applied 4 oz. per acre of the acid equivalent in the form of sodium salt, amine salt and ester. The varieties divided into tolerant and susceptible, only the susceptible varieties suffering any measurable loss of yield at this level of application. Abnormalities produced included stem curvature, fasciation, and fusion of leaves and of bolls.

J.L.F.

Mastitis : Equipment for Milk Sampling and Examination

The treatment of mastitis calls for professional skill and should remain a matter for veterinary surgeons ; but it is likely that in bacteriological diagnosis of the causative organism all competent available help will be needed to cope with the problem on the large scale. To obviate fallacious reports of the presence of pathogens resulting from the contamination of milk samples from sources outside the udder, great care in sampling is necessary.

The necessity for precautions is enhanced when samples have to be sent considerable distances to the laboratory. The delays in transit which so often and so inevitably occur increase the difficulties of examination, and many samples arrive in such a condition that no satisfactory result can be obtained.

Neave, Taylor and Lawes (*Proc. Soc. App. Bact.* **1** (1949), 34), realizing these and other difficulties, have evolved a simple sampling technique which, over several years, has given results equal to those secured by the examination of fresh milk samples. The practical advantage is that samples from suspected cows may be taken by the farmer or the advisory staff. Both the equipment required and the instruction needed in taking samples are simple.

Six-oz. rectangular sample bottles were used. About 8 ml. per bottle of blood agar was added, cotton wool plugs inserted, the bottles placed on their sides, and the agar allowed to set. After drying and testing for sterility the bottles were sent to the farms. About 5 ml. of milk from the cow's teat was milked directly on to the agar surface in the bottle, the excess over the quantity necessary to wet the surface poured off, and the bottles posted or taken to the laboratory, where they were incubated and examined in the same way as petri dishes. The examination of many hundreds of samples taken by this method has proved that the principle is sound, but the authors point out that the bottles used, simply because they were available, are not ideal. (Later modifications by other workers have proved to be successful.)

Penicillin and the Lactic Streptococci

The lactic streptococci which are used as starters in cheesemaking and for other purposes in the dairy industry are known to be sensitive to penicillin.

When the drug became generally available for the treatment of mastitis in cattle it seemed likely that, if residues of penicillin were present in the milk of cows treated by the ordinary method of repeated udder infusions, difficulty in cheesemaking and other processes might be experienced. The matter has been reported on by G. J. E. Hunter (*J. Dairy Res.*, **16,** 2 (1949), 235).

He found that very small concentrations of penicillin (0.07 unit per ml. of milk) had a marked effect on a single-strain starter. The effect varied with the concentration of the residual penicillin, from delay in reaching the desired acidity to complete inhibition of acid formation. The sensitivity of various strains of starters varied, but some were completely inhibited in the later stages of cheesemaking. Penicillin was

found to be virtually unaffected by pasteurization of the milk, and it was shown to be more stable to heat in milk than in other fluids.

The quality of cheese made from milk containing small quantities of penicillin was adversely affected. On determining residual penicillin in the milk of cows treated for mastitis it was found that the milk might contain as much as 5 units per ml. of milk. It is clear that it is possible for milk supplied to factories for cheesemaking to contain sufficient penicillin to affect adversely the cheesemaking process.

Penicillin and the Methylene Blue Test

G. J. E. Hunter (*J. Dairy Res.*, **16**, 2 (1949), 149) has investigated the effect of penicillin on the methylene blue reduction test. Here again small concentrations were found to increase the reduction time, in many cases permitting samples to pass the test when they should have failed. Some members of the flora of milk are susceptible, and others, e.g., the coliform organisms, are insusceptible to penicillin. The widespread therapeutic use of this drug is likely to have effects on the measurement of milk quality as well as on the manufacture of dairy products.

A.T.R.M.

DAIRY HUSBANDRY

Grazing of Dairy Stock

Recent investigations in connection with grazing, and the practical suggestions to be made from them, include studies of the grazing behaviour of the animal, improved grazing management of leys, suggestions for the provision of winter grass and its utilization, and a study of probable causes of bloat in the grazing animal.

The normal behaviour of the dairy cow at pasture in New Zealand has been described by Hancock (*N.Z. Dairy Exporter*, **24** (1948), 18) after observations on six sets of identical twin in-milk heifers during eight 24-hour periods of the season. On average the cows grazed 6.83 hours per day, 60 per cent of this time falling between morning and afternoon milking. Grazing time was longest in December, declined during summer, and rose again in autumn, this trend being determined mainly by the quality of the grass. The cows lay down 9.25 hours and took 23,500 bites of grass per day. At the Grassland Improvement Station, Drayton, bullocks grazed for an average of 8.72 hours per day—93 per cent during the daylight hours (*Grassland Improvement Station, Rpt. Expts. in Progress* (1948) p. 43). Stapledon (*Agriculture*, **55** (1949), 461), after watching steers on virgin downland, estimates that two-thirds of their grazing time is spent in obtaining short green leafage, and one-third in eating dry and dead vegetation. This tends to substantiate his conclusion (*Agriculture*, **55** (1948), 231) that animals, if given the

chance, graze so as to maintain a particular balance between " eatable " matter and dry matter, and between fibre and readily digestible nutrients. Evans and Evans (*J. Brit. Grass. Soc.*, **3** (1948), 249) suggest that when cattle, grazing a clover-dominant sward, search for " browse " it is because they have recognized a warning from their own physiological mechanism that they are absorbing harmful constituents from the sward.

The grazing management of calves and heifers, whereby all animals from the age of one month are rotationally grazed round the same pastures as used by the milking herd is described by Gerring (*N.Z. J. Agric.*, **75** (1947), 603) and McMeekan (*N.Z. J. Agric.*, **77** (1948), 138). The method is recommended by Cooper (A.E.A. paper read 16.12.48) for this country. During 1948 calves at Wye which had been out at pasture from weaning were perfectly thrifty and, although not weighed, were judged to be above average for their age. For efficient utilization of grassland, Cooper suggests fields of 10 to 12 acres temporarily divided into three parts and feeding 10 to 15 cows per acre over a period of one or two days. With the use of the portable electric fencing equipment now coming on the market, the daily folding of grassland is envisaged by Foot (*J. Soc. Dairy Tech.*, **2** (1949), 95).

Experience in the management of outwintered cattle on grassland during 1947-48 is outlined by Hughes (*Agriculture*, **55** (1948), 98) when 17 steers were maintained on 14 acres of grass (sown in drills) for the period January 9-March 19, the animals each receiving a supplement of 10 to 15 lb. of hay per day. A working plan for the production of winter grass suggested by Stapledon (*Agriculture*, **55** (1949), 461) based on his observations and including some of the above findings includes the sowing of a field in strips, one-third in succulent winter green herbage and two-thirds in older, more mature material. The strips would alternate and winter grazing would be taken in sections by running a temporary fence across the strips. Means of winter grazing on rape or kale " pastures " are outlined by Stubbs (*Agriculture*, **55** (1948), 369), who indicates that the winter grazing crop is the cheapest winter food when milk is at its highest price. By grazing kale as opposed to cutting and carting it, costs per ton were reduced by approximately two-thirds. The precise method and equipment required for the winter grazing of kale is described by John (*Agriculture*, **55** (1948), 283), who claims a 50 per cent saving in growing and utilizing the crop.

New light is thrown upon the probable causes of bloat in grazing animals by recent work of Evans and Evans (*J. Brit. Grass. Soc.*, **3** (1948), 249), part of which confirms earlier evidence of Ferguson (*Nature*, **161** (1948), 816). The latter worker demonstrated the partial paralysis of gut as the result of legume juices as opposed to grass juices ; similar results were obtained by Evans and Evans using hydrocyanic acid—a substance found in most pasture species, especially clovers. One pint of clover juice (from 4 lb. of leaves) introduced directly into the rumen of a 100 lb. sheep resulted in death within two hours. Animals

after ravenously grazing a lush clover ley had a higher HCN content in their blood than normal. Observations on Somerset pastures by Bathe (*Agriculture*, **55** (1948), 235) during 1944 and 1945 indicate the greatest incidence of the trouble during June and July, particularly when the weather favours bursts of succulent non-fibrous herbage. Night pasturing on coarse fibrous pastures and daytime feeding on the more active grazing leys is recommended.

Chemical Quality of Milk

There is considerable evidence to show that the chemical quality of milk has deteriorated during the present century. Professor H. D. Kay has summarized the position in a paper on " Quantity and Compositional Quality of Milk " (*The Sanitarian*, **56** (1948), 322). S. J. Rowland dealt with the same problem in a paper on " Trends in the Chemical Composition of English Milks ", which he read before the XIth International Congress of Pure and Applied Chemistry (Report in the Press). A. L. Provan and D. I. Jenkins also presented a paper on " Trends in Milk Quality " (*J. Soc. Dairy Tech.*, **2** (1949), 28). Some of the important causes of deterioration in milk quality have not yet been established definitely, but all three of the papers mentioned above give a useful summary of present knowledge of the subject. Short discussions on " Factors affecting Milk Yield and Butterfat," by J. Hammond (*Digest of the British Cattle Breeders' Club*, **3** (1948), 94) and by J. Mackintosh (*Jour. R.A.S.E.*, **109** (1948), 48) also bear on the subject. W. H. Hillman (*South Devon Herd Book Soc. Annual*, **2** (1948), 71) discusses factors affecting the fat content of milk under the following subheadings : Effect of Breed, Age of the Cow, Lactation, Weather, Feeding, Intervals of Milking, Stripping. For readers in German, the very comprehensive compilation " Milk Industry in Switzerland " is recommended. This contains chapters dealing with milk quality and discusses efforts aimed at its improvement (*Die Schweizerische Milchwirtschaft* (1948), 162-77 and 549-630).

In recent years endocrine stimulants have been brought into the field of milk production and there has been a number of papers on the effects which some of these substances have on milk quality. S. Bartlett, S. J. Folley, S. J. Rowland, D. H. Curnow and S. A. Simpson (*Nature*, **162** (1948), 845) suggested that an oestrogen may be responsible for galactopoietic effects of spring grass in lactating cows. These workers have analysed samples of herbage cut from a number of pastures during the period of active growth and found oestrogens present in them. It has been suggested that the substantial and immediate rise in non-fatty solids content of milk when the cows are turned out to grass in the spring is caused by oestrogens present in young grass. The fact that winter grass or hay was found to contain no oestrogens supports this hypothesis.

The possibility of markedly changing the composition of milk by feeding iodinated proteins continues to receive attention. A recent paper dealing with the subject is that by R. G. Swanson and C. B. Knodt

(*Jour. Dairy Sci.*, **32** (1949), 257), who found that when the amount of iodinated protein is comparatively small—say, less than 5 g. per head daily, as compared with 15-20 g. usually recommended—there is no increase in either milk yield or fat percentage.

Results of two experiments have been reported dealing with changes in compositional quality of milk as affected by diet. F. Whitting, J. K. Loosli, V. N. Krukovsky and K. L. Turk (*Jour. Dairy Sci.*, **32** (1949), 133) reported that feeding 5 oz. of cod liver oil per head for five weeks during the winter increased milk yield by 6 per cent and decreased fat percentage by 14 per cent. The carotene content of the milk fat was depressed, but its vitamin A content increased. D. B. Parish, G. H. Wise, J. S. Hughes and F. W. Akeson (*Jour. Dairy Sci.*, **31** (1949), 889) found that by feeding heifers for seven weeks before parturition on the basis of a high v. low level protein ration, they could not materially influence the total protein, casein, and albumino globulin fraction of colostrum and early milk.

The question of composition of milk from the point of view of suckling calves was dealt with in a paper by H. D. Eaton, A. A. Spielman, R. E. Johnson, L. D. Matterson and R. J. Slater (*Jour. Dairy Sci.*, **31** (1948), 685). They reported results of experiments showing that pre-partum milking materially alters the composition of the first milk secreted at the termination of pregnancy and produces a milk much lower in nutritive value, as indicated by the analysis.

Dealing with quite a different aspect of the problem, A. Hanson and G. Bonnier (*Acta Agric. Suec.*, **3** (1949), 179) published a further paper reporting on their studies on the genetical determination of the composition of milk. Their recent results confirmed that the values which the percentages of protein and lactose attain at fixed fat percentages are mainly determined genetically.

Milking Method

Partly as a result of widespread interest in the processes involved in efficient milking, a number of surveys have been made on milking routine and cowhouse labour organization. Woodworth, H. C. *et al.* (*New Hampshire Agric. exp. Sta. Circ.* 1947, 76) advocate milking routines which include " quick milking " methods and intimate that cows can normally be machine-milked and stripped in 4 minutes. Woodworth also reports that following an extensive campaign, about one-third of the farmers who tried the new method had successfully mastered it in one year (*N.A.A.S. Quart. Rev.*, **1**, 1 (1948), 22). There is, however, considerable evidence of large herd-to-herd and cow-to-cow variation in milking time. Thus Murphy (*Farm. Econ.* (N.Y.), 161 (1948), 4173) has recorded time and travel records in 22 hand- and machine-milked herds comprizing nearly 500 cows, 87 per cent being machine-milked. The average milking time per cow varied from 3.85 minutes in the fastest herd to 8.50 minutes in the slowest ; the average of all herds was slightly over 6 minutes. Because 70 per cent of the farmers adopted hand stripping after the machines it was calculated that the average milking and stripping time was approximately 7.5 minutes per cow. Thirty per

cent of all the cows took over 7 minutes to milk. Failure to train the cows to milk quickly was given as the reason why 63 per cent of these cows were slow milkers. Murphy (*Farm Econ.* (N.Y.), 164 (1948), 4238) has also published certain time schedules for milking. The standards laid down permit a machine milking time per cow of 4.15 minutes when the milker operates two bucket units, washes his own cow and carries the milk. It is suggested that if an extra man were available to carry the milk the time could be reduced to 3.15 minutes per cow, and with a person to wash and carry the milk it could be reduced to 1.75 minutes per cow, provided the " cows could be trained to milk out in this time ".

The ability to train cows to milk out quickly has been investigated by Dodd and Foot (*J. Dairy Res.*, **15** (1947), 1 and *N.A.A.S.Quart. Rev.*, **1,** 2 (1948), 72). Further evidence collected by the same workers has confirmed their earlier findings (*J. Dairy Res.*, **16** (1949), 14). In one experiment using twenty cows an attempt was made to milk ten of the cows in 60 per cent of their " normal " machine milking time. The cows were washed immediately before milking and the treatments continued for five weeks. Reducing the time allowed for milk removal caused a reduction in milk yield and had little effect on rate of milking. In a second experiment with ten cows the milking machines were left on the cows for twice the length of time necessary to milk the cows at every milking for six weeks. Again there was no effect on the rate of flow of milk from the cows ; milk yield was not affected. The authors suggest that these results emphasize the difficulties involved in attempting to change the inherent rate of milking by changes in management. Though Smith and Petersen (*J. Dairy Sci.*, **31** (1948), 589) and Whittleston (*N.Z. J. Agric.*, **78** (1949), 273) have shown that management can increase the time needed to milk the cows by inhibiting " let down," the published evidence suggests that cows, under the best milking routine, milk at widely differing speeds and that it is exceedingly difficult to alter substantially this rate by training or management methods.

The results of an investigation into labour organization in milk production are given in a recent publication (Sturrock, F. G., *Rep. Fm. Econ. Camb. Univ.* No. 32 (1949)). In general, the labour requirements decrease with increasing herd size in both hand- and machine-milked herds. The labour requirement in man hours per cow per year was 232 in hand-milked herds compared with 194 for machine-milked herds. This saving in time was mainly in actual milking time. There was little effect on the other labour operations. Within the machine-milked group the labour requirements were 182 man hours per cow per year for bucket milked cows in a cowshed, but only 139 man hours for bail milked cows passing through a " parlour ".

The second part of the report deals with a detailed investigation of milking which accounts for 45-55 per cent of the labour involved in milk production. It consists of a detailed critical analysis of labour utilization on a number of farms adopting various routines and with widely differing facilities and labour teams. Organization of labour and building layout

are shown to have a major influence on labour cost and fatigue. Estinates of fatigue, as indicated by distances walked by the milkers, were made by using a standardized routine in cowsheds of various designs. Fatigue increases with increased size of cowshed ; it is greater when a single row house is used and when the dairy is at the end of a long cowshed instead of the middle. The designs and advantages of parlours, yards and " two level " milkers is also discussed. Although the author claims " no finality " for the results obtained the report is a valuable guide for those concerned with advisory work on milk production.

A.S.F.

POULTRY HUSBANDRY

Investigations concerned with substitute feeding materials and animal protein continue to form a large part of poultry research work. Latterly much of this work has been directed towards the problem of ascertaining the nature of the animal protein factor. Quite recently vitamin B.12 was hailed as the vitamin responsible for the accelerated metabolism associated with the feeding of animal protein. Since that announcement a more cautious attitude has developed, and it is now widely believed that vitamin B.12 still is only part of the complex that is commonly known as the animal protein factor. There is a recent paper endorsing the need for animal protein by Emerson, Houston,Thayer, and MacVicar, in *Poult. Sci.*, **28** 3, (1949), 431-5, on " Studies on All-vegetable Protein Rations ". The authors demonstrate the inadequacy of an all-vegetable protein ration for adequate chick growth and show how improvement can be effected by various supplements which include fish solubles and liver extracts. The use of the former is interesting ; apparently in California extensive use is made of this substance conjointly with alfalfa meal and with no other addition of animal protein. The use of fish solubles would appear to be a profitable field to develop in this country.

An interesting article which, apparently, supports the view that the animal protein factor is not solely concerned with vitamin B.12 is that by Lindstrom, Moore, Petersen, and Wiese on the " Activity of a Vitamin B.12 Concentrate for Chick Growth and Hatchability," published in the *Idaho Agricultural Experiment Station Research Paper* 292 (1949). The authors describe the big improvement in the hatchability of fertile eggs of birds fed 1 per cent of vitamin B.12 concentrate in a diet otherwise deficient in the animal protein factor. While, however, this result was obtained with vitamin B.12, the authors point out that the addition of 3 per cent herring meal resulted in a higher level of hatchability, and ascribed this result to some additional factor carried in the protein of the herring meal.

A paper on an allied subject has been written by Lloyd, Reed and Fritz on " Experiences with High Protein Diets for Chicks and Poults " (*Poult. Sci.*, **28,** 1, 69-74). The data supplied by these authors suggest that while high protein rates, e.g., at levels of 20 per cent and above, may

give early growth, this advantage is largely lost by the time maturity is reached. Higher rates of protein seem, therefore, to have no commercial advantage, and at such levels as 36 per cent, toxic effects were observed.

A subject that is causing increasing concern amongst poultry-keepers in this country is the apparent increase in the incidence of fowl paralysis. Waters and Bywaters discuss an aspect of this disease in a paper entitled " The Age of Chicken at Contact Exposure on Incidence of Lymphomatosis " (*Poult. Sci.*, **28**, 2, 254-61). The experiment described supports their conclusions by demonstrating that when eggs from stock which were free, or relatively free, from naturally occurring lymphomatosis, were hatched and reared with chicks produced from known infected stock, a high proportion of the chicks from the free stock showed lymphomatosis. When hatched and reared in isolation they remained relatively free from the disease. One point of interest was the fact that the chick exposed to contact with the hatches from infected stock showed a relatively lower mortality from the disease when contact was not brought about until after thirty days. On the evidence so presented it appears that the absence in incubators of eggs from infected stock is eminently desirable by hatchery owners, and pedigree breeders would be well advised to hatch and rear in isolation from their own stock all eggs purchased from another breeder.

Another phase of the same problem is dealt with by R. K. Cole in a paper on " The Egg and Avian Leucosis " (*Poult. Sci.*, **28**, 1, 31-44). The author describes experimental work in which mortality rates caused by neoplasms did not differ between the progeny from dams or sires dying with leucosis and from those that did not die. It appears, therefore, that embryonic mortality is not affected by the presence of the parents dying from the development of leucosis during or shortly after the breeding season. This conclusion is of great interest in view of the facts offered by Waters and Bywaters.

A paper by Nordskrog, Penquite, and Crump (*Poult. Sci.*, **28**, 1, 98-105) deals with a rather unusual subject, " Factors affecting Students' Ability to Judge Poultry ". The subject is of topical interest in view of the widespread interest in poultry judging by Young Farmers' Clubs, where officers of the N.A.A.S. are invited to adjudicate. In the study under review, eighteen students and four experienced judges placed at four different times the same thirty-two utility and sixteen exhibition classes of birds, each class consisting of four birds The utility classes were placed more consistently than the exhibition categories. The general standard of the scoring was high, and the difference between the average scores between students and experienced judges was not significant ; but the difference between individuals was excessive. The authors appear to have some doubts about the value of judging as a guide to students' abilities. With very little training those students able to judge with ability can be picked out. It is stated that probably 100 birds would be needed to discriminate between the relative ability of two students as judges, and doubt is cast on the value of such a competition.

R.C.

DDT on Cattle and in Dairies. Tissot, A. N. *Press Bull.* 630. University of Florida Agriculture Experimental Station.

This bulletin provides a useful account of the scope and use of DDT against a number of cattle pests, particularly flies, both on the animals themselves and in the farm buildings. The type of DDT spray recommended is the wettable powder. Sprays containing from 1 to 2 per cent DDT have been found to give satisfactory results, the higher strength having a greater residual effect. Provided that a large proportion of the animals are treated, several weeks will elapse before fly populations build up again. DDT sprays have given an excellent control of horn flies, mosquitoes, lice and fleas. For lice the spray applications must be thorough, the brush of the tail, the withers, the neck, and other parts of the animal where lice congregate being wet thoroughly. Lice eggs are not killed, but the residual effect of the spray results in the killing of the young lice as they hatch.

Dipping is not recommended because it is an expensive way of using the insecticide. In addition there is some risk of injury to the cattle—a risk that does not occur with spraying.

A spray containing 2 to 2½ per cent DDT applied to the walls and ceilings of farm buildings will give effective control of flies for a number of weeks. Spraying of walls requires lower pressures than are used for the treatment of animals. One gallon will treat almost 1,000 square feet, the aim being to apply the spray in large droplets so that the surface is well wetted without the liquid running off.

Warning is given that a few simple precautions are necessary. Feeding troughs and drinking vessels should be covered or removed whilst spraying is being carried out ; foodstuffs and dairy utensils must similarly be protected. Emulsion sprays, where the DDT is carried in oil should never be used on animals because the substance can be absorbed directly through the skin when in this formulation.

Specifications and Methods of Analysis for Certain Insecticides and Fungicides. Ministry of Agriculture *Technical Bulletin No.* 1.

This, the first of a series of Technical Bulletins, will be found of great interest to those advisory officers who are concerned with spray materials. The bulletin is a record of the specifications and methods of analysis which have been accepted by the Ministry, the Government chemist, and the insecticide manufacturers, and has provided the basis for the Ministry's voluntary approval scheme for insecticides and fungicides.

Whilst the bulk of the information is not of a kind which is in any way necessary for the advisory officer's work, the bulletin will nevertheless provide a useful and interesting insight into the composition of the various types of product and of the standards required.

Laboratory Experiments on the effect of DDT and BHC on certain Aphidophogous Insects and their Hosts. Way, M. J. *Bull. Ento. Res.*, **40** (1949), 2.

Experiments were carried out during 1945 and 1946 to determine the effects of insecticides, particularly DDT and benzene hexachloride, on various hover flies and ladybird beetles. The relationship between

a pest and the various checks, both predators and parasites, is very complex, and the use of insecticides imposes further complications. Where a pest and its checks are reduced to approximately equal extents by an insecticide it is probable that little harm is done ; but the danger of insecticides is more apparent when an insecticide is more destructive to the natural enemies than to the pest. An all too familiar example is the increase of red spider that has occurred as the result of the use of DDT, which kills the Anthocorid bugs that are predatory on the red spider but has no effect on the pest itself.

The beneficial insects used in the tests were hover fly adults and larvae, ladybird beetles and larvae, adult braconid parasites and the larvae of a species of gall midge predaceous on aphids. Parallel tests were also carried out with the insecticides on aphids. Insecticides tested were DDT, BHC, rotenone, and nicotine.

The experiments provided confirmation of the fact that nicotine is a selective insecticide so far as hover flies and ladybirds are concerned. Hover fly larvae and the adults, larvae and eggs of ladybirds were unaffected by nicotine. Hover fly larvae were unaffected by rotenone, though the eggs of ladybird were killed by rotenone, as also were the larvae and, in varying proportions, the adults.

BHC showed toxic properties to all the beneficial species tested. Braconid parasites and hover flies were highly susceptible and the BHC did not exhibit any repellent action. The BHC was toxic to the aphids, but many of these would be missed in situations protected from the sprays. There may, therefore, be selective destruction despite the susceptibility of the aphids.

DDT was toxic to hover fly adults but not to the larvae ; it was toxic to ladybird adults and larvae, but not to the eggs. The toxicity of DDT was, however, less than that of BHC, but its relatively slight effect on aphids may cause its use in the field to be more favourable to the increase of aphids than BHC. DDT inhibited egg-laying by hover flies, and a cabbage plant treated with a 0.2 per cent DDT spray suffered greater damage from cabbage aphis than an untreated plant because of this inhibition of egg-laying and the consequent absence of the predatory larvae.

The whole problem is both interesting and important in view of the development, reported by other workers, of resistant strains of insects and their artificial selection by insecticides. Predators and parasites may play a very important part in the destruction of such resistant individuals contained within the pest population.

L.N.S.

Verticillium Wilt of Hops

At the present time Verticillium Wilt of hops is causing more concern than any other fungus disease of this crop ; it has been responsible for heavy losses in the Weald of Kent. Dr. Keyworth of East Malling Research Station has been investigating the problem since 1938, and he and his co-workers have made known their results in the form of a series of papers.

In the first of these [1] they showed that Verticillium Wilt is caused mainly by *Verticillium albo-atrum* and occasionally by *V. Dahliae*. Two types of the disease can be differentiated : in a fluctuating attack the intensity of the disease varies from year to year, affected plants being scattered through the field at random. The important characteristic of this type of attack is that frequently affected plants recover in subsequent seasons. In progressive outbreaks affected plants occur usually in large groups and the affected area increases each year. Most infected plants die in one to two years. Much of the early work was concerned with this progressive type of attack, owing to its greater economic importance. Experiments showed that diseased leaves and bines were important agents in spreading the disease. Cultivations were responsible for distributing some of the diseased material along the rows. Also the planting of infected cuttings helped to spread the disease. In some cases, outbreaks of the disease appeared to be associated with previous plantings of raspberries and potatoes. Tentative suggestions are made for control measures. These consist mainly of hygienic practices concerned with the removal of infected leaves and bine as early as possible.

In the second paper [2] Dr. Keyworth gave an account of his attempts to select varieties of hops resistant to Verticillium Wilt. None of the common commercial varieties tested showed any high degree of resistance, so that the selection had to be made from new varieties, particularly those raised by Professor Salmon at Wye. First, these varieties were tested on a small scale in plots of infected soil and any showing promise were tested further in field trials on areas in commercial farms where the disease was present. Of the new Wye varieties three (O.V.53, O.M.26, and A.E.E.55) were highly resistant, and in addition two other varieties (219 and O.R.55) were moderately resistant. A variety raised on a commercial farm, 1147, also showed moderate resistance. More recently [3] two other Wye varieties, O.R.55 and O.S.47, have been classified as moderately resistant and also acceptable to brewers.

Isaac and Keyworth [4] conducted a series of experiments on variations in pathogenicity of different cultures of *V. albo-atrum* isolated from hop plants taken from both fluctuating and progressive outbreaks of the disease. They showed that isolates obtained from plants taken from the fluctuating outbreak were less pathogenic to young hop plants than those from progressive outbreaks. They concluded that the differences in symptoms and intensity of attack seen in the two types of outbreak in the field were caused mainly by these differences in pathogenicity of the strains of the fungus rather than by variations in other external factors.

Later, Keyworth [5] described his observations made on an outbreak of Verticillium Wilt of the fluctuating type. The number of plants

showing symptoms was recorded each year from 1943 to 1945, and there was increase in the number of plants showing symptoms in the field. However, isolations of the fungus were obtained from cuttings of plants which appeared normal. The author suggested that external environmental conditions influenced the appearance of the symptoms. No evidence could be obtained that the presence of a large number of plants showing symptoms in one portion of the field was correlated with soil type. Subsequently, Keyworth and Hitchcock [6] showed that in addition to the environmental factor already postulated, the appearance and symptoms might be affected by the forward or late nature of the bines of infected plants.

Another aspect of the problem was discussed by Keyworth and Hewitt [7] in a paper dealing with the effect of hop nutrition on infection with a progressive strain of Verticillium Wilt. Two experiments were carried out in which hops were grown in sand cultures supplied with various nutrient solutions. In the first experiment the cuttings were planted in 1944 and the pots in which they were grown were inoculated with a progressive strain of *Verticillium albo-atrum* the following year. In this experiment the wilt symptoms were less severe in plants showing deficiency of nitrogen, phosphorus, potash and possibly magnesium. A similar experiment was started in 1946 and continued in 1947. In this experiment the only plants to show less severe symptoms were those lacking in nitrogen.

H.E.C.

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VIROLOGY

Yellowing Disease of "Family 41" Sugar Beet. Watson, M. A., Hull, R. and Hartsuijker, K. *Nature*, **163** (1949), 910.

The authors of this letter dispute the statement of Clinch and Loughnane (*Proc. Roy. Dublin Soc.*, **24** (1948), 307) that a form of Virus Yellows of sugar beet is transmitted by the seed.

They admit that a yellowing disease in a "pure line" of sugar beet may be seed-transmitted but contend that it is a distinct disease from virus yellows, and differs both serologically and in symptomatology. The fact that some beet seedlings of Family 41 have a transmissible chlorosis does not in any way affect the control of Sugar Beet Yellows.

A Preliminary Account of Experiments and Observations in Denmark, 1946, concerning Virus Yellows of the Beet Plant. Hansen, H. P. Copenhagen, Nielsen and Lydicke (1947).

This is a statement on the situation as regards Virus Yellows of the sugar beet in Denmark. The author's conclusions agree with the results obtained in this and other countries. Neither fertilizers nor spraying with a mixture of nicotine and DDT or with Bordeaux mixture exerted any beneficial influence on the course of the disease.

Sur une Virose Nouvelle de la Betterave : La Jaunisse des Nervures. Roland, G. *Parasitica*, **4** (1948), 152-4.

What appears to be a new virus disease of sugar beet has been described in Belgium. The name given is "vein-yellowing," and the disease was observed on forage beets growing near Gembloux. The virus is not sap-transmissible but is carried by the aphid *Myzus persicae*. Symptoms consist of chlorosis of the outer leaves with some necrotic streaks and vein-yellowing of the young leaves. The disease seems similar to that described by Sylvester (see next abstract).

The Yellow-net Virus Disease of Sugar Beets. Sylvester, Edward S. *Phytopath.*, **38** (1948), 429-39.

Diseased plants exhibit a bright yellow chlorosis of the veins, which starts in the main lateral veins of the youngest leaf. The symptoms often vary in intensity and in the amount of lateral spread of the chlorosis from the veinlets into adjacent tissues. In inoculated plants, the net-veining is frequently preceded by the appearance of several scattered yellow spots.

Transmission of Sugar Beet Yellow-net Virus by the Green Peach Aphid. Sylvester, Edward S. *Phytopath.*, **39** (1949), 117.

The primary vector of the Yellow-net virus is the aphid *Myzus persicae*. The aphid can acquire the virus after 5 minutes feeding on an infected plant and transmit it after 15 minutes feeding. This is thought to indicate that mesophyll penetration is sufficient for acquisition of virus but that the phloem is the essential tissue involved in inoculation. The aphid retained the virus for 11 days, or for the duration of its experimental life. The vector-relationships of the Yellow-net Virus seem similar to those of Sugar Beet Yellows in this country.

Sugar Beet Yellows and the Mangold Crop. Sugar Beet Research and Education Committee. *Agriculture*, **55,** 12 (1949), 450-2.

Sugar Beet Yellows reduces the yield by half when the crop is infected in early August. One of the most important overwintering sources of infection is the mangold clamp and, in addition, clamps are often severely infested with the aphid vector. Infestation is likely to increase during April and it is recommended that clamps should be used up by early April and the site cleared and ploughed. Where this is not possible, special clamps of roots, from which all the leaves and shoots have been removed at harvest time, should be made. Alternative, but less important, sources of infection are red beet, wild beet, groundkeeping plants of beet and mangold, and the biennial plants of seakale and spinach beet in gardens.

The Transmission of Sugar Beet Yellows Virus by Mechanical Inoculation. Kassanis, B. *Ann. appl. Biol.*, **36** (1949), 270.

Sugar Beet Yellows virus, hitherto transmitted only by aphids, can be transmitted mechanically to sugar beet if a suitable abrasive is used. Most inoculated leaves develop local lesions, but usually systemic infection occurs in only about 10 per cent of the inoculated plants. Systemic symptoms develop more slowly than in plants infected with aphids.

Some Unreported Host Plants of Sugar Beet Mosaic Virus. Bennett, C. W. *Phytopath.*, **39** (1949), 669.

Up to the present the virus of sugar beet mosaic has been thought to infect only the *Chenopodiaceae*, but Bennett shows that quite a number of other plants are susceptible. This suggests possible sources of infection hitherto unsuspected.

Beet Mosaic Virus ; Green Peach Aphis Relationships. Sylvester, E. S. *Phytopath.*, **39** (1949), 417-24.

The experimental results have suggested the following conclusions as to the transmission of the Beet Mosaic virus by the green peach aphid.

The acquisition and inoculation thresholds lie somewhere between six and ten seconds, with a mean transmission threshold value of approximately one minute. The pre-infection feeding starvation period, to be effective, must be between two and five minutes. Aphids starving, following an infection feeding, begin to lose their ability to transmit the virus within two minutes, but the loss appears to be greater after fifteen minutes of starvation. When an infective insect is fed on a healthy plant, both the number of punctures that are made and the duration of any single puncture can affect the chances for inoculation.

From these results it is apparent that any attempt to stop the field spread of such a virus should consider at least the following points : the degree of infestation, the normal activity of the insects involved, the type of population especially in reference to the number of alate or winged forms present, and the potential results of any control programme upon population movement and general restlessness.

Studies on the Chemotherapy of Potato Virus Diseases. Locke, S. B. Abstract in *Phytopath.*, **38** (1948), 916.

Treatment of a hill of Leaf-roll infected Netted Gem potatoes with 0.2 per cent 2.4-dichlorophenoxyacetic acid resulted in the complete masking of symptoms in the new growth produced after treatment, and also in the first vegetative generation of plants grown from the tubers of the treated plant. Grafts made at intervals from the first vegetative generation progeny of the treated plant to healthy plants showed no transmission at first, and later, increasing proportions of transmission up to 100 per cent. Symptom development was slower in the earlier transmissions and more rapid in the later ones relative to rate of symptom appearance after transmission of untreated diseased plants. These results are interpreted as indicating a reduction in amount of active virus in the treated plants and not merely masking of symptoms. Re-inoculation of first generation, vegetative progeny of the treated plant by grafting with scions from non-treated Leaf-roll plants failed to induce symptom development.

This may indicate that amounts of the active chemical sufficient to inhibit virus multiplication were present in the plants at the time of re-inoculation.

Kennebec : A New Potato Variety resistant to Late Blight, Mild Mosaic and Net Necrosis. Akeley, R. V., Stevenson, F. J. and Schultz, E. S. *Amer. Potato J.*, **25** (1948), 351-61.

Kennebec (U.S.D.A. seedling No. B. 70-5) a new potato variety developed at the Plant Industry Station, Beltsville, Maryland, possesses good commercial qualities and a high degree of resistance to blight (*Phytophthora infestans*) in both tubers and haulms. In field exposure tests it was also highly resistant to mild mosaic and did not develop Net Necrosis in the tubers. It is late maturing in Maine, but medium-late in other States.

Leaf-Roll in Relation to Second Crop Seed-Potato Production on Long Island. Cunningham, H. S. *Bull. N.Y. St. agric. Exp. Sta.*, (1948), 731.

From 1942-45 an attempt was made to produce disease-free second-crop seed potatoes (Irish Cobbler) on Long Island. The Leaf-roll content of such potatoes is normally high (70 per cent in some cases, while 30 to 40 per cent is not uncommon) owing to the use of inferior seed stocks, the presence of infected volunteer plants in the field, and the difficulty of isolating seed plots.

Although the production of disease-free tubers is hampered by the isolation problem, reasonably disease-free seed can be obtained by using clean seed, planting on land which has not produced a potato crop earlier in the season, and by reasonable aphid control. Little difference was observed between the yield or Leaf-roll content of northern-grown seed and Long Island second crop seed.

Leaf-roll, Net Necrosis, and Stem-end Browning in Netted Gem Potatoes in California. Oswald, John W. and Kendrick, James B. *Phytopath.*, **38,** 11 (1948), 917.

Leaf-roll is very serious in *Netted Gem* potatoes because current season infection markedly reduces yield and causes Net Necrosis in the tubers. Reduction in yield is directly proportional to the severity of plant symptoms. In addition to Net Necrosis, *Netted Gem* potatoes develop Stem-end browning. Tuber indexing showed net necrosis was definitely associated with Leaf-roll, whereas Stem-end browning was not. Tubers from 90-day-old plants had only a trace of Net Necrosis, but after six weeks' cellar storage (about 45°F.) and cold storage at 36°F., showed 23 and 5 per cent respectively. Mature tubers, harvested after killing frost, showed 40-50 per cent Net Necrosis and 10-15 per cent Stem-end Browning with no subsequent increase in either cellar or cold storage.

Multiplication of Clover Club-leaf Virus (*Aureogenus clavifolium*) **in its Insect Vector.** Black, L. M. *Phytopath.*, **39** (1948), 2-3.

This is interesting as being the second authentic case of transmission of a plant virus from an infected female insect to the progeny. The experiment has been continued for 4 years through 15 generations without loss of infectivity. The work also suggests that the virus must multiply in the insect vector since, if no multiplication of virus is assumed, passsage through 15 generations is equivalent to a dilution of 10^{-17}.

Strains of Cucumber Mosaic Virus Pathogenic on Crucifers. Pound, G. S. and Walker, J. C. *J. agric. Res.*, **77** (1948), 1-12.

Two strains of this ubiquitous virus isolated from *Hesperis matronalis* in Wisconsin were found to be infectious to all members of cruciferae tested. In this country the virus is occasionally found infecting kale on a field scale.

The Relation between the Susceptibility of Tomato Plants to Virus Infection and Certain Physical Factors of the Environment. Howles, R. *Rep. Exp. Sta. Cheshunt* (1947), 22-28.

The author's results suggest that more virus enters a wilted leaf than a turgid one. The rate of transpiration did not appear to influence the severity of virus symptoms. To determine the effect of rate of multiplication of Mosaic virus, twenty-four plants were inoculated and next day twelve were placed in the moist, and twelve in the dry, chamber for 10 days. Eight of the plants in the moist chamber and three in the dry developed head mottling. Thus for the same amount of virus absorbed the rate of symptom development is greater in the turgid plant.

In a study of the relation between susceptibility to virus infection and the amount of water added to the soil, plants were maintained at various stages of turgidity between turgid and flaccid during and after inoculation with Aucuba Mosaic virus. The results showed that the degree of mottling decreased with increasing amounts of water added—that is, with increasing turgidity. When, however, the plants were inoculated

before being subjected to differential watering, the turgid ones proved to be the more susceptible.

Tomato plants should be kept turgid in order to retard rate of entry of virus.

Aerial Surveys of the Incidence of Nettlehead Disease on the Hop on Former Hedgerow and Pasture Sites. Keyworth, W. G. and Hitchcock, M. *Rep. E. Malling Res. Sta. for* 1947, 153-6.

An aerial survey of hops where an outbreak of nettlehead had occurred showed that affected plants tended to occur on the sites of old hedgerows in certain fields. In another field there were many more affected plants on a part that had once been old pasture than on a formerly arable section. There was no evidence as to the basic causes of these effects.

K. M. S.

INSECTICIDES AND FUNGICIDES

Parathion

At the second International Congress on Crop Protection, held in London on July 20-30, 1949, a whole session was devoted to the organophosphorus insecticides. Of these materials, HETP has already been described in this REVIEW (**1**, 1 (1948), 44) and the suspicion that it is a mixture has been confirmed. The most active component is tetraethyl pyrophosphate, which is present in amounts up to 20 per cent. By a modification of the manufacturing process this content has now been raised to nearer 40 per cent, and to this more insecticidal product the initials TEPP have been applied. Both TEPP and HETP are available in compounded forms which have proved successful for the control of aphids and red spider.

The rapid hydrolysis of these products to non-poisonous products, when diluted with water, though removing spray residue problems, prevents their use as protective contact insecticides. For this purpose another compound was developed, O.-*p*-nitrophenyl O.O.-diethyl thiophosphate, known in German literature as " E.605 " and christened parathion. Following the successful use of compounded forms of this chemical, in particular for aphid and apply sawfly control, enquiries on its potential uses have been frequent. But an incomplete knowledge, particularly of its chemistry, has so far frustrated reliable work ; several contributions at the Congress go far towards resolving some of the difficulties. Crude parathion containing up to about 70 per cent of the required thiophosphate have been available in this country, although in the U.S.A. products reputed to have a purity of 95 per cent are on the market. Attempts to purify the crude product by the usual methods of

distillation have failed, and it is now known that when heated even to the moderate temperature of 150°C. parathion undergoes profound and remarkable changes in structure, resulting in a loss of insecticidal properties, at least to the grain weevil, *Calandria granaria*, accompanied by the disappearance of sulphur in the thiono form in which it was originally present in the thiophosphate (Bennett S.H. *et al. Long Ashton Res. Sta. Ann. Rep.* (1948), 138-52). One change responsible is the formation of an isomer in which the sulphur is bound in mercapto form becoming O.-*p*-nitrophenyl O.S.-diethyl thiophosphate. Dr. Barnes, of the M.R.C. Toxicology Research Unit, reported that this isomer has a far greater mammalian toxicity than parathion. Moreover, it is now suspected that reported instances of parathion being absorbed and translocated within the plant are the result of the use of a product containing this unwanted isomer. Fortunately, recent German work by Frohberger (*Höfchen Briefe*, **2**, 2 (1949), 10) indicates that parathion is enzymatically decomposed to non-insecticidal products in the presence of plant tissues ; if so, the dangers of unsuspected spray residue toxicity, owing to absorption by the plant, seem less formidable. But clearly the greatest caution is still necessary in recommending parathion until methods are available for ensuring the absence of toxic isomers. For aphis and red spider control, the safest phosphorus insecticide is still either HETP or TEPP.

The parathion situation is complicated still further by the evidence which Professor Ketelaar gave to the Congress that recent German products, reputed to be based on E.605, contain not the original diethyl thiophosphate, but the corresponding dimethyl ester—a compound more readily hydrolyzed than parathion, apparently slightly more insecticidal (at least, to some insects), and, according to Dr. Barnes, of somewhat lower mammalian toxicity.

Nomenclature

The introduction into commercial practice of new insecticides and fungicides with unwieldly and tongue-twisting chemical names has led to international action on nomenclature. Clearly, if nicotine had been first introduced as a synthetic compound its chemical name, 3-(1-methyl-2-pyrollidyl) pyridine, it would have been necessary to find a common name for it. Similarly with the thiophosphate mentioned above—the name chosen is parathion, written without a capital as nicotine is written. Other agreed common names are DDT (without stops), BHC for crude benzene hexachloride, chlordane, and toxaphene. The latest addition to the list is lindane, selected as the name for the gamma isomer of benzene hexachloride of a purity of not less than 99 per cent ; the isomers of BHC were first isolated as far back as 1912 by Van der Linden. Confusion over the misused term " Gammexane " will be avoided if it is remembered that " Gammexane " is a brand name for lindane (not BHC, as often supposed), manufactured by the proprietors of the trade mark name " Gammexane ". Because it is a trade mark, " Gammexane " should be given a capital letter and placed between inverted commas.

H.M.

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